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THE M. A. C. BULLETIN
AMHERST, MASSACHUSETTS

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MASSACHUSETTS AGRICULTURAL COLLEGE

THIS ISSUE OF THE BULLETIN CONTAINS THE REPORT OF THE PRESIDENT AND OFFICERS OF ADMINISTRATION FOR THE YEAR ENDING NOVEMBER 30, 1929, WHICH IS A PART OF THE SIXTY-SEVENTH ANNUAL REPORT OF THE MASSACHUSETTS AGRICULTURAL COLLEGE AND AS SUCH IS PART I OF PUBLIC DOCUMENT 31. (SECTION 8, CHAPTER 75 OF THE GENERAL LAWS OF MASSACHUSETTS)

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MASSACHUSETTS AGRICULTURAL COLLEGE

REPORT OF THE PRESIDENT TO THE BOARD OF TRUSTEES, 1929

The preparation of an annual report is the occasion for a review of progress and a survey of future problems and needs. In preparing for this particular report, I have been struck by the fact that a very considerable number of the items which appeared in my preceding two reports as problems to be solved are to appear in this one as achieved results. This brings a feeling of satisfaction in which I trust that you, the members of the Board of Trustees, will feel your full share. Progress is being made. You have full right to a sense of satisfaction in unselfish service, well-rendered to the Commonwealth of Massachusetts.

REVIEW OF THE YEAR

The Staff

The effect of the state system of classification of personnel in reducing changes in staff becomes more and more apparent. This year there have been only 19 resignations from the college staff which consists of 261 persons. Dr. W. R. Hinshaw, Chief of Laboratory in the Poultry Disease Control Service, resigned on July 31, 1929 and Dr. Henry Van Roekel was appointed to fill the vacancy. Dr. Van Roekel had been in charge of this laboratory in 1926–27 and has had valuable experience in the George Williams Hooper Foundation for Medical Research at the University of California since then. Mr. H. W. Yount resigned on August 31 as Assistant Professor of Agricultural Economics and Dr. A. H. Lindsey was appointed as Professor of that subject. Dr. Lindsey is a graduate of the University of Illinois and has received the Ph.D. degree from Iowa State College. He has taught Economics at Alabama Polytechnic Institute and at Iowa State College and takes up his work at this College well qualified to render good service. All other changes have been in minor positions.

We were grieved to learn of the death on October 19, at Santa Barbara, California, of William R. Hart, Professor Emeritus of Agricultural Education. Professor Hart served this College as Professor of Agricultural Education and Head of the Department from 1907 to 1923 and was well known and much loved by many of our faculty, alumni and other citizens.

Professional Improvement for Staff Members

Attention was called last year to the need for some plan whereby members of the staff might have leaves of absence for advanced study or for professional service which would increase their value as teachers or research workers. Several months' study of this problem resulted in the presentation to and approval by your Board and the administration officers of the State of a definite plan for this purpose, of which the essential features are as follows:

1. This opportunity is a privilege to be applied for in each individual case and in no sense an earned perquisite; and it is to be granted in each case only by vote of the Board of Trustees after consideration of a specific application approved by the President and accompanied by a satisfactory statement of how the leave is to be used by the applicant for professional improvement.
2. This privilege is open to all staff members ranking as assistant professors or above who have been in the continuous service of the institution for at least six years, with at least three years in the rank of assistant professor or above, and thereafter not more frequently than once in seven years.
3. The leave is for a maximum period of one-half year on full pay.
4. For members of the staff employed in Extension work and the Experiment Station, the leave may be granted for any time of the year, while absences on the part of members of the teaching staff will be usually limited to the half year composed of either the spring and summer term, or the summer and fall term.

It is probable that applications for leave of absence under this plan will be limited to a relatively few persons per year, but that it will serve a very useful purpose in providing opportunity for ambitious members of the staff of desirable mental caliber and views, to improve their capacity for service to the institution.

Out-of-state travel for attendance at meetings of scientific societies for the purpose of professional improvement has been permitted on the same basis and to approximately the same number of members of the staff as in recent former years.

Also, several of the members of the staff who are permitted by the rules of the College to carry a limited amount of advanced work in our own Graduate School have done so. And, finally, two groups of staff members have organized for regular systematic study of methods of research and advancement in scientific knowledge.

This very general acceptance of these opportunities for professional improvement by members of the staff indicates a very satisfactory attitude on their part toward their work and ability to serve the best interests of the College.

Honorary Degrees Conferred

At the annual commencement exercises on June 17, 1929, two honorary degrees were conferred upon outstanding alumni of the College. The degree of Doctor of Laws (LL.D.) was conferred upon William Wheeler, a graduate of the class of 1871, who served as a Trustee of the College for more than forty years, retiring at the close of his term of office on December 31, 1928, and who is a civil engineer of nation-wide reputation. The degree of Doctor of Science (D.S.) was conferred upon Charles S. Plumb, of the Class of 1882, emeritus professor of animal husbandry at Ohio State University, known throughout the world as an author and teacher in the field of animal husbandry.

The Course of Study

Several changes in the courses of study which are offered to students who come to our campus for resident instruction of various types have been put into operation this year.

In the four-year degree course, the new plan of major specialization became operative with the entering class in September of 1928, that is, this year's juniors in the College. It is now in satisfactory operation and already gives indications that it will provide curricula better fitted to the needs of most students than

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was possible under the former system of departmental specialization. The present senior class is the last one to be under the former system and when it is graduated next June the whole student body will be under the new plan. It will then be much easier to classify the students according to their desired objectives and to fit their program of studies better to the combined results of scientific foundation, cultural experience and vocational or professional training which is our avowed aim.

A modest beginning has been made this year in the five-year course in landscape architecture by rearrangement of the program of the first four years of the course to give a somewhat broader basic training and the introduction of a part of the courses which will constitute the fifth year's work when the plan becomes fully operative next year.

In the Stockbridge School of Agriculture, the opportunity for a student to select a variety of unrelated courses of study was definitely closed and each student, of either sex, is now required to pursue a fixed curriculum in one of the following majors: animal husbandry; dairy manufactures; poultry raising; flower growing; fruit growing; general horticulture; or vegetable gardening. This has resulted in some reduction in the number of women students, who formerly enrolled for some unorganized work in home economics, and of students of both sexes, who formerly took a variety of unrelated courses in several fields of agriculture or horticulture. But there has been a noticeable improvement in quality and earnestness of work because of the definiteness of purpose and objectives which the present plan requires of all students in the School.

In the Winter School, a similar change has been instituted with similar results. The former plan of listing a considerable number of courses to be offered and permitting a student to select from these such as appealed to his choice or fancy at the moment has been replaced by offering certain definite curricula covering ten weeks of instruction in the following general subjects: dairy and livestock raising; general farming; golf greenkeeping; poultry raising; and flower growing. Also, special two-weeks programs in milk plant operation; ice cream making; and in feeding and dairy herd management are provided. The first and most noticeable effect of these changes is that the total enrollment for the Winter School this year has increased by nearly sixty per cent, most of these special courses being filled to their specified limit of capacity, and in some cases advanced enrollment has already been made in order to insure admission to these courses in 1931.

Student Enrollment

In common with many other colleges throughout the country, student enrollment has this year declined. While the advanced classes are larger, the entering classes in both the four year degree course and the Stockbridge School were smaller than last year and the total enrollment is slightly smaller. The actual decrease in these two major units is only from 827 to 821, but the total enrollment in all resident courses is only 1,044 as compared with 1,133 of last year, the major portion of this decrease being in summer school and winter school enrollment. It is impossible to say whether this is a temporary fluctuation such as has occurred from time to time during the last decade of general expansion, or whether it marks the beginning of a diminution of interest in higher education, especially that of the short course type. It is probably the former.

Special Educational Meetings at the College

Forty special educational meetings were held at the College this year, including three meetings at the Market Garden Field Station at Waltham. These were attended by more than 12,000 persons, the actual records of counted or estimated attendance totalling 12,273. This indicates the extent to which the facilities of the College are used beyond the regular services of resident teaching, extension and research. The growth from year to year in the number of meetings and the attendance is encouraging to those who wish the College to be of maximum service to the Commonwealth.

The annual Farm and Home Week conducted by the Extension Service was successful as usual, bringing 3,500 visitors to the campus, where lectures and demonstrations of modern farm and home practices were given.

The New England Grange Lecturers conference was held on the campus in August and was attended by 1,000 delegates from the six New England States. The program was in charge of Grange officials and the College cooperated with them in furnishing facilities for the meetings.

The annual High School Day was again attended by nearly 1,000 high school boys and girls and teachers. This was the twentieth consecutive High School Day and there seems to be no question of its value in bringing to the attention of the young people of the State the opportunities which this College offers for higher education. The interscholastic judging contests which are conducted by the College in connection with the High School Day program continue to attract a great deal of interest. This year 222 contestants representing 33 schools judged fruit, milk, poultry, live stock and vegetables in the various contests.

The Massachusetts Elementary Principals' Association held its first conference at the College this year and is planning to make this an annual meeting. The Eastern Farm Bureau Training School brought to the campus last summer leaders in Farm Bureau work from many eastern and some midwestern states.

I believe that it is good for the College to have these many visitors and it certainly increases our usefulness to be able to serve this ever increasing group.

Repairs and New Construction

The Horticultural Manufactures Building, for which the legislature of 1929 made available the sum of $70,000, is nearly completed and will be ready for occupancy by the opening of the third term of this college year. It is a two-story brick structure 112′ x 50′ in size, of the general factory type of construction and is located just west of Flint Laboratory where service from the power plant is easily available. It will provide greatly improved facilities for instruction and research work in horticultural manufactures, but will not relieve, to any considerable extent, class-room and laboratory space in other buildings, since the work has been carried heretofore in very inadequate quarters scattered through several other buildings.

The meats laboratory, or abattoir, for which $14,000 was available, has been erected as an addition to Grinnell Arena and all of the work of studying live meat producing animals and their carcasses after slaughter can now be done in one building and with adequate modern equipment.

A six-car concrete garage, a new cement walk from South College to the ravine north of North College, a new poultry house and hot water brooder, the reconstruction of the Brooks farm barn to serve as an isolation barn for producing cows which react to the test for contagious abortion, and the tiling of the walls in the milk-receiving room in Flint Laboratory are minor improvements in physical plant equipment which were completed during the year at a total cost of $18,400.

The sum of $10,000 was spent in the construction of an 18-inch stone-bed macadam road, 18 feet wide, for a total distance of 2,730 feet past the front of South and North Colleges to the power plant and as far as the ravine on the way to the north part of the campus. It is hoped that this excellent beginning in improvement of campus roads may be continued by similar additions in subsequent years until the campus is fully provided with roads which will bear the heavy traffic to which they are subjected.

Better Fire Protection

It has been known for some time that the volume and pressure of water available at many points on the campus is inadequate to provide real protection if a serious conflagration should start. Surveys of this situation last summer suggested two possible means of improvement in it. One is to install a better circulating arrangement in existing water mains, with larger general feed lines, and a request for a modest beginning in this has been included in the list of items for

permanent improvements to be provided in the 1930 budget. The other calls for improvement in the quantity and pressure of water available to the campus from the mains of the Amherst Water Company. Provision for this has been made by a plan for the erection, on the highest point on the east side of the campus, by the Amherst Water Company, of a half-million gallon steel water tank, and its direct connection with our general mains. Authority has been requested from the legislature of 1930 for the College to assign the right to the Water Company to erect this reservoir on college property. If these improvements can be followed later by installation of larger general water mains to strategic points on the campus, adequate fire protection will be insured.

PROBLEMS AND POLICIES

Name and Scope of the College

The question whether the name of this institution should be changed, either accompanied by or without any significant change in its scope and resident teaching activities, is being discussed by several different groups of interested friends of the College. I believe that the fundamental question at issue is whether, in the future, the College shall be narrowly vocational or professional in the field of agriculture alone, or shall serve as the land-grant college in Massachusetts to provide for "the liberal and practical education of the industrial classes for the several pursuits and professions of life," as indicated by the original Act of Congress which provided for the establishment of these colleges. On this point, I have definite and profound convictions which I shall be glad to present for your consideration at the appropriate time. I believe, however, that that appropriate time will be after the publication of the results of the survey of these land-grant institutions which has just been completed by the Federal Bureau of Education. I understand that the report of this survey will be available early in the coming year and I shall be ready shortly thereafter to present my views with reference to the various aspects of the problem for your consideration.

Gifts and Endowments

One of the indirect, but by no means unimportant, results of the physical education building campaign which has been in progress for the past two years, has been the bringing of the attention of public-spirited donors of funds for the promotion of education to the unique opportunity which this College offers for philanthropic service of this kind to an unusually worthy group of students. Students who come to this kind of a college are almost without exception those by whom a college education is desired as a definite preparation for service to society in some special vocation. In general, they come from homes of moderate means, with a background of experience of working for what they get and of appreciation for what they earn by their own efforts.

To aid a group of such students to secure the education, which they earnestly desire and appreciate and plan to use in trained service for community welfare in some specific vocation, is an opportunity of the highest order for those who have funds to donate for the promotion of collegiate education.

It would seem to be evident that it is not necessary for a state-supported institution to solicit funds to provide building equipment for class-room, laboratory, or other curricular instruction. But there are other items of assistance to worthy students in the way of provision of dormitories or other suitable living quarters, funds for scholarships and loans to needy students, opportunities for social or recreational habit formation, and the like, which reach unusually promising and appreciative recipients in a college group such as ours.

During the past two years, we have received several such gifts, the use of which will materially increase the opportunities for student advancement here. Notable among these are: The Massachusetts Federation of Women's Clubs' gift of $3,000 as a memorial to Helen A. Whittier, to be used as an endowment for "Scholarships in Art as Applied to Living;" the Robert F. Pomeroy gift of $1,500 to

be used for the purchase of books for the library; the Admiral Barber bequest of $5,000 for use in promoting physical education, the income from which has been assigned to the construction of a series of "Admiral Barber tennis courts;" and the gift by a group of several interested citizens of approximately $45,000 towards the cost of the new physical education building which is soon to be erected on the campus.

It is sincerely to be hoped that benefactions of this kind may continue to come to the College, and its friends will render a real service to the cause of education if they continue to present to possible donors this opportunity for aid to a student group which is unique in its potentialities for service and appreciation of its privileges.

The Five-Year Building Program

Last spring the Board of Trustees received from the Chairman of the State Commission on Administration and Finance a request that it present on June 1, 1929, a five-year building program planned to meet the needs of the College for the period beginning in 1930.

A similar request made in 1926 resulted in the presentation of a plan which called for twenty items of buildings and permanent equipment which were at that time believed to be necessary or desirable to promote the future welfare of the College. The total estimated cost at that time for the permanent improvements needed at the College was $1,257,325. During the period in question only one of the major items of that program (the Horticultural Manufactures Building) has been provided. This, with a few minor items, costing a total of $108,000 is the only progress which has yet been made toward the realization of the plan then presented. Hence, it might have seemed to be necessary now only to resubmit the plan of four years ago in order to comply with the present request.

But there have been certain notable shifts in plans for our collegiate work in response to changes in student major elections, an increase of nearly 50% in our Experiment Station activities in response to the opportunities afforded by the Federal Purnell Act, and a continuing development of our Extension Service and Control Service since the former report. Also, certain new methods, whereby a part of the institution's needs for building equipment may possibly be met by other means than direct state appropriation, have been under consideration. Hence, it seemed best to meet the new request by a careful consideration of the situation as it now exists rather than by a simple reiteration of the preceding five-year program.

The task of preparation of such a program is more difficult than it might seem at first glance. Excessive enthusiasm for the cause of education in general and for that which is provided by this College in particular might easily stimulate the imagination and inspire hopes for rapid development of physical plant equipment here. On the other hand, too serious consideration of the State's financial policy, not to increase either state taxes or state indebtedness, might lead to a conservatism in building for future needs, or even for relief of present inadequacies, which would seriously limit the service the College can render to the Commonwealth.

The Board of Trustees, with its joint responsibility to the Commonwealth for wise administration of this state activity, and to the College for proper presentation of its needs to the State's administrative officials and appropriating bodies, sought to find the best possible recommendations to be made in order to promote the best and wisest development of the educational opportunities which the State can offer here to its citizens.

It was recognized at the outset that the activities of the institution include many other things besides teaching of resident students. In fact, only approximately 54% of the institution's funds are expended for resident teaching. Naturally, building equipment must be provided for the research work of the Experiment Station, for Control Service laboratories, and for the housing of the required central office administration of the Extension Service. In the past, this has been done chiefly by encroachment upon the space and facilities originally provided

for resident teaching. This was possible without serious difficulties so long as the resident teaching load was diminishing; but now that it is on the increase, serious complications have arisen. The result is that the needs for facilities for resident teaching are much more acute than the increase in student enrollment alone would seem to indicate.

One fact is clear and fundamental to the consideration of any building program; namely, that the College now has adequate laboratory facilities in many departments, and an instructional staff which could take care of at least fifty per cent more students with very slight additions in cost for these two major items of expense for our type of education.

Efficient use of existing facilities of this kind require a larger student body and the State's need for a well-educated citizenship would be helped by a larger number of graduates from this College. But the possibility of more students here is now limited by dormitory facilities, physical education and exercise equipment, library study room, and lecture room space. Hence, the first problem is to provide relief from these limiting factors to the usefulness of the College, and then to take care of such obvious improvements and additions in equipment as wise administration of the Trustees' dual responsibilities would suggest.

Dormitories

The provision of dormitories for student use continues to be the most serious limiting factor in the development and use of the College. The town of Amherst is a small one with limited capacity to provide rooming facilities for the students of the two colleges. The limitation of enrollment of students at Amherst College is the only reason why the situation has not become more acute than it is, and the town is now taxed to capacity. Further, there are many valid reasons why freshmen students in particular should be required to live in residential halls under institutional supervision during the earlier periods, at least, of their college course. Hence, the need for dormitories is even more urgent now than heretofore.

But in view of the questions of policy involved in the erection of dormitories by direct state appropriation and of the apparent desirability of attempting to provide these necessary housing facilities for students through other methods, such as have been adopted by similar institutions in other states, the Trustees have decided to recommend that the only provision for dormitory facilities through direct state appropriation during the coming year-five period be by restoration of North College and South College to their former uses as dormitory and recitation buildings and the remodelling of them to accommodate some sixty additional students on a more modern arrangement of rooms, toilet facilities, etc. This will require as its first step the vacation of the parts of South College which are now used as administrative offices, so that a proposal is made for the erection of a **new administration building** as a necessary part of this plan, as well as to meet the growing needs for more adequate administrative arrangements.

Physical Education Building

One of the most lamentable lacks of proper building equipment for a modern educational program at the College is the almost complete absence of any provision for a proper physical education program. The old Drill Hall, which is the only building available for this purpose, has been inadequate for the last twenty years. This need is growing more acute and more distressing with each succeeding year, and adequate provision to meet it ought to be a definite part of any constructive building program for the future.

Moreover, the Associate Alumni of the College have recognized this imperative need of their Alma Mater and have undertaken to raise at least a substantial part of the necessary funds for the erection and equipment of a suitable building for this purpose. At the time of writing of this report, it is apparent that this alumni enterprise will result in a definite proposal to the administrative officials of the State that the funds which the alumni have been able to secure be supplemented

by state appropriation sufficient to insure the erection of a satisfactory physical education building, so that it will not be necessary for the Trustees to include this as an exclusive state appropriation item in the five-year building program.

Recitation Facilities

One of the very acute needs of the College is for more recitation rooms. The necessary absorption of former recitation rooms for use as administrative offices, as the institution's varied activities have grown, has resulted in a steady diminution of recitation room space until now it is almost impossible to program the regular class work in the available rooms. This has resulted in the scattering of the work of several of the departments all over the campus, with results disastrous to their integrity and morale.

Recognition of this situation led to the inclusion of plans for a new recitation building in the earlier considerations of the present five-year building program. Later considerations of the possibility of restoration of the north wing of South College to its former use as recitation rooms; for which the floor arrangements, lighting arrangements, etc., are most suitable; suggested this method of provision for the immediate needs for increased recitation room space. Further, the erection of a new administration building as recommended above will release other rooms in various buildings over the campus, so that the need for recitation rooms for the next five years probably can be taken care of in this way, and on the assumption that it will be so cared for, a request for a new recitation building is omitted from the present program.

Landscape Architecture Building

One of the departments of the College which, by reason of development of the economic importance of its work and opportunities for profitable employment of its graduates, has grown steadily and rapidly in student enrollment in recent years is that of landscape gardening and landscape architecture. Present quarters for this work in Wilder Hall are wholly inadequate as well as encroaching seriously upon the pomology work which must be given in the same building.

There is, therefore, urgent need for increased laboratory space for this Department. Our proposal is that the old Stockbridge farmhouse be renovated, remodelled, and restored to its former characteristic arrangement as a New England farmstead building and used as a landscape architecture laboratory. This would provide a building which would be wholly of wooden frame construction and hence not at all fireproof. But there is little danger from fire from the uses to which the building would be put, and the restoration and preservation of Stockbridge House in accordance with its original lines, as a typical New England farm building, would have many historic and sentimental advantages and would be a particularly appropriate housing for the Landscape Architecture Department. A necessary prerequisite to this use of this building will be the erection of a modest house for the horticultural foreman who now occupies Stockbridge House, at an estimated cost of $6,000.

Library

The question of how to provide adequate study rooms for students and faculty in connection with the College Library has been up for consideration by the Board of Trustees for many years. Also, the fact that many extremely valuable, if not irreplaceable, collections of books and periodicals are now in grave danger of loss by fire is a serious factor in the matter of permanent library facilities. Two major proposals for meeting this situation have been before the Board of Trustees from time to time. One called for the erection of a new library building wholly separate from the present quarters. The other contemplated the fireproofing of the present "Old Chapel" building interior and the addition to it of necessary increased space. Detailed consideration of problems of location, use of present buildings and architecture of the present stone building seem to indicate clearly the greater desirability of the latter of these two plans.

But, since the present library building is of stone construction and of characteristic Gothic architecture, it does not lend itself well to piecemeal reconstruction at successive intervals as needs for increased library facilities develop. Hence, the only alternative seems to be to attempt to secure funds for a complete reconstruction of the building at one time, with the thought that this will take care of the library needs of the College for at least a quarter of a century to come. Hence, the estimate for this purpose which is included in the five-year building program is put upon that basis.

Home Economics Laboratory

The instruction in home economics for women at the College has developed a little at a time and is now housed in four different buildings on the campus, to the detriment of its own development and with the limitation of the possibilities of using the present quarters for the purposes for which they were originally intended and are now urgently needed. It is now proposed that the East Experiment Station Building (if its present use for administrative offices be released through the erection of a new Administration Building) be devoted to the housing of all home economics instruction work. The location of this building is excellent for this purpose and its structural arrangement can be easily adapted to the proposed new use.

Some slight remodelling of the present rooms of this building will provide adequate and satisfactory offices and classrooms for the Department, but a new wing will need to be added at the back to provide for food and nutrition and clothing laboratories. A small and relatively inexpensive addition would provide for the absolute necessities for the next five years, but it would seem to be wiser to build now enough space to provide for possible growth for at least ten years to come and the estimated cost of $43,000 for remodelling and new construction and $18,000 for plumbing connections and laboratory and classroom equipment has been computed on that basis.

Addition to Fisher Laboratory

A two-story 30′ x 50′ addition to the cold storage building known as Fisher Laboratory is proposed, at an estimated cost of $8,000, in order to provide much needed receiving and temporary storage space for fruit from the college orchards which are now coming into bearing, and laboratories for fruit-packing practice work by students.

New Greenhouses

The old "Taft" greenhouses now used by the Vegetable Gardening and Floriculture Departments were built in 1886 and are now nearly at the end of their usefulness. It would be altogether unwise to spend money for their repair as they are of an obsolete type of construction. In anticipation of the necessity for new greenhouse construction, plans have been drawn for a new range, with central potting shed and cellar, to be built as an addition to the present houses back of French Hall. This range, if built complete, would cost about $45,000, but it is estimated that $25,000 will build such parts of it as may become necessary during the next five-year period. These can be built in such a way as to permit the completion of the range at some later time without increase in total cost or loss of immediate efficiency.

Physics Laboratory

The Department of Physics is now very inadequately and unsatisfactorily housed in a wooden frame building which is wholly unsuited to precision laboratory work. This fact has long been recognized and provision for better quarters anticipated in the plans for the combined Physics and Microbiology Building, one wing of which was erected in 1916. The present request is for the completion of this building as originally planned, to house the Departments of Physics, and Mathematics and Surveying, all of which are now located in old frame buildings originally erected to serve as dwelling houses or offices.

Steam and Service Lines

Two of the main service lines for steam on the campus have been in use for thirty years, which is approximately the maximum length of life for such pipes. Hence, it is almost certain that it will be necessary to replace one or more of these during the next five years. An item for this purpose is inserted in the list below.

Road Construction

Progress should be made from time to time in hard-surfacing the roads on the campus. Also, a new road, to constitute a south entrance to Fisher Laboratory and the President's House, should be built and an estimate for this purpose is included.

Better Fire Protection

The present six-inch water main which serves the entire campus is insufficient to supply two high-pressure streams of water for fire fighting purposes and it is recommended that provision be made for installing a new eight-inch main extending from the entrance of the Amherst town supply to the campus to the several fire hydrants.

Remodelling of Rooms in Draper Hall

The main dining room in Draper Hall is now crowded to capacity and if student enrollment continues to increase it is anticipated that it will be necessary to remove certain partitions and construct a new women's dining room on the second floor.

List of Estimates of Needed Funds

The preliminary estimate of funds necessary to provide for these additions to permanent equipment at the College during the next five-year period is as follows, the items being arranged approximately in the probable chronological order of need:

1.	Administration Building	$150,000
2.	Remodelling of North College	30,000
3.	Restoration of South College	25,000
4.	House for horticultural foreman	6,000
5.	Remodelling of Stockbridge House for Landscape Architecture	36,000
6.	New Library construction & fireproofing	250,000
7.	Home Economics Laboratory and equipment	61,000
8.	Addition to Fisher Laboratory	8,000
9.	Additional greenhouses	25,000
10.	Physics Laboratory	150,000
11.	Service lines	50,000
12.	Road construction	40,000
13.	Fire protection (new water mains)	50,000
14.	New dining room in Draper Hall	13,000
		$894,000

CONCLUSION

I believe that this report shows that definite progress is being made in meeting the administrative problems which are an inevitable part of any live and growing institution. This is as it should be. Hence, I close this report with an expression of my congratulations to you upon the progress which is being made by the institution which is in your charge. I believe that the interests of the Commonwealth of Massachusetts as represented at its Agricultural College are being protected and fostered by your intelligent care and unselfish efforts in a very remarkable way. May I add expression also of my own personal appreciation of the help which you have given in the many matters of college policy and administration which I have presented to you during the year.

Roscoe W. Thatcher,
President.

BUDGET FOR 1930

The following requests for appropriations for the support of this institution for the fiscal year beginning December 1, 1929, have been transmitted to the Commission on Administration and Finance for consideration in connection with the preparation of the state budget for the year.

General Maintenance

	Personal Service	Maintenance Expenses	Total
General College	$442,410	$113,800	$556,210
Experiment Station	89,310	20,085	109,395
Extension Service	67,035	40,100	107,135
Market Garden Field Station	8,600	6,500	15,100
Short Courses	60,320	12,400	72,720
Heat, Light and Power	–	54,500	54,500
Physical Plant Expenses	22,000	36,000	58,000
Fertilizer Control Law	10,500	3,600	14,100
Poultry Disease Law	21,500	16,000	37,500
Milk Testing Law	600	900	1,500
Commercial Feeding Stuffs Law	9,000	2,000	11,000
Seed Control Law	3,925	1,575	5,500
Laboratory Service	4,890	750	5,640
Trustee Expenses	–	1,200	1,200
Printing Reports	–	1,500	1,500
Totals	$740,090	$310,910	$1,051,000
Emergency	–	–	5,000
Total request for maintenance	–	–	$1,056,000

Permanent Improvements

1. Physical Education Building and Equipment, $172,500

This item is to provide for the construction of a building as proposed to the Commission on Administration and Finance which it is estimated will cost $287,500. One hundred fifteen thousand dollars ($115,000) is to be contributed by the Alumni-Trustee Physical Education Building Campaign Committee. The need for this building is great and has been repeatedly pointed out. Dr. Howard J. Savage of the Carnegie Foundation spoke as follows concerning this need: "I believe that I am right in informing you that the facilities for indoor athletics and for dressing, bathing, etc., at the Massachusetts Agricultural College stand among the least adequate of any at the one hundred and twelve institutions of the United States and Canada visited for the athletic enquiry of the Carnegie Foundation. They certainly contrast sharply and unfavorably with those at many other state institutions."

2. Library, Additions and Fireproofing, $175,000

As a result of a careful study of the library needs of the College by a special committee of the faculty, it is pointed out that approximately twice the present floor space is needed. For example, at present the library conveniently accommodates only 70 readers whereas provision should be made for 150 on the present enrollment basis. No coat rooms or toilets are now provided. Book storage space is so deficient that the dirt floor basement and extra shelves to the ceilings have to be utilized and the availability of books to readers is greatly reduced. The present business office and workrooms are very inadequate. In view of the fact that the contents of this building are estimated to be worth $500,000, much of which could not be replaced if destroyed by fire, it is very important that the present building and new additions be made as fireproof as possible. The method for fireproofing the present building has been specifically recommended by State Fire Inspector, Ira C. Taylor.

3. Remodelling of North College Dormitory, $30,000

This building now houses 52 students on its five floors including the basement. All toilets are in the basement and the interior construction is in very poor repair. Remodelling and renovation as contemplated in this project will increase student accommodations to 70. It would make possible increase in annual income amounting to approximately $5,000. The amount requested includes $7,000 for equipment and furnishings.

4. Addition to Fisher Laboratory, $8,000

The steady increase in the crops of fruit from the plantations of the Pomology Department, particularly in the experimental blocks (most of which are just coming nicely into bearing and will continue to increase for some years), and the increasing number of students in the Department, particularly in the Stockbridge School of Agriculture, are causing a serious congestion at Fisher Laboratory. To relieve this condition it is proposed to erect at the north end of Fisher Laboratory an addition 30 x 50 feet. There would be a storage cellar below, with a packing room on the main floor, and room for storing empty packages above.

5. Road Construction, $10,000

It is proposed to continue the macadam construction of this year around the main campus road to the Experiment Station and from there to Wilder Hall, a distance of approximately 2,000 feet.

6. Water Mains for Fire Protection, $5,000

Upon the recommendation of the State Engineer, it is proposed to increase the size of certain water mains and to tie together certain lines which now have dead ends in order to improve the possibilities for fire protection.

REPORT OF THE DEAN

Whatever else may be assigned to the Dean's Office at Massachusetts Agricultural College, two phases of administrative responsibility must be definitely centered there. First, the maintenance of reasonably high standards of scholarship, and second, the enforcement of regulations and the development of student organization for the control and proper direction of student behavior. The college community is a unit and harmful influences within the group must be controlled. Orderliness, contentment and well directed organizations are valuable aids to scholarships. Again, high regard and earnest zeal for thorough scholarship and its realization through definite channels of opportunity make the disciplinary regulation comparatively easy.

The methods employed for the encouragement of good scholarship have been outlined to you in my former reports. These are still used, though altered, of course, to suit changed conditions. Several of these changes deserve mention here. It has been our practice to be rather lenient in admitting students who have failed to make good on their first attempt in college either at Massachusetts Agricultural College or at other institutions. Such students would be given another chance to prove themselves, provided they could present letters of honorable dismissal. When, however, thirteen of the twenty-three transfers admitted last year failed or withdrew and several others made unsatisfactory records during the year, we greatly restricted this opportunity and thereby eliminated at the source one of the drags on good scholarship.

In order to dignify good scholarship, the Honorary Society of Phi Kappa Phi conducts one of the regular weekly assemblies during the fall term. The exercise is simple, but dignified and impressive. A brief statement explaining the aims of the society, the presentation of the newly elected undergraduate members, the awarding of the society's $100 scholarship, and an address by a distinguished scholar are the principal features of the program.

Another method for the encouragement of good scholarship was started this year. Under the supervision and direction of a special committee called the Honors Committee, definite honors work of two different types is now available for seniors. The first is a one term Honor Course of three credits given by a different professor each year. The instructor is allowed the greatest freedom in the matter of course content and method of presentation. Since only high ranking seniors are eligible to take the course, it is hoped that the students will consider it a real honor to qualify. On the other hand, it should be stimulating to any instructor to know that he is working only with exceptionally capable students. The course was given during the spring term this year by Dr. Ray E. Torrey and was elected by fifteen students.

The second form of honors work is called "Departmental Honors." According to this plan, high ranking senior students recommended by any department authorized by the Honors Committee, pursue individual studies, readings and investigations to the extent of three credits each term. At the end of the year, the student must satisfy the Department and the Honors Committee on the standard of achievement. If the work merits, the student will be listed on the Commencement program as receiving honors in his field of specialization. Departmental Honors are now offered in Agricultural Economics, Chemistry, Dairying, Physics and Pomology. No definite results can yet be reported, but any plan which selects the best students, offers them a rigorous course of study, and allows them to work with the greatest possible freedom, will undoubtedly be successful.

As has been the practice for a number of years, much time and work was given to the members of the freshman class. No one questions their need of careful guidance during the period of adjustment to college work. The following members of the staff assisted the Dean as advisers this year: Assistant Dean Lanphear, Professors Julian, Serex, Skinner, Dunbar, Goding, Messrs. Boutelle, Briggs and Miss Packard.

It is gratifying to report that Massachusetts Agricultural College has an Honor System that is working with considerable success. On this point a paragraph from an editorial in the "Collegian" of December 4, 1929, deserves quoting here: "At this College we have in operation at the present time an Honor System which we believe is working very effectively. The fact that during each year there are only a few cases brought before the Honor Council might be evidence that the system is not working. However, this is not the right interpretation, for a small percentage of cases, most of them dealing with minor charges, shows clearly that the system is operating successfully. It points as evidence to the high standard of honor which is prevalent among the students."

During the year a study was made to decide upon the advisability of an honor point requirement for graduation. The Scholarship Committee examined the records made, subsequent to graduation, by five men of the lowest scholarship standing from each of the classes, 1913, 1914, 1915, 1916, 1922, 1923, 1924. These convinced the Scholarship Committee and the Course of Study Committee that such men, judging by the positions which they are now holding, were not unworthy of our degree. Nor did it seem that they should be made to work more than the usual four years for the degree. The Committee's findings are embodied in the following statement:

"After extended consideration and discussion, it appears to the Committee, and rather to its surprise, that the record made by the lowest ranking members of a graduating class at this College scarcely warrant a rule requiring a certain proportion of C grades as a prerequisite to graduation. The general sentiment of the Committee, is, rather, that the machinery of scholarship should be kept as simple as possible. The Committee wishes to reiterate its faith in the 40% rule which seems to be highly effective in taking care of delinquent students who, in certain other colleges, are dealt with in later years by a rule governing honors points.

"In regard to the general question of improved scholarship, the Committee feels that the establishment of the system of honors groups is working most satis-

factorily as an incentive to better work. It also believes that the proposed institution of honors courses is another step in the right direction and that it will act not only as an incentive, but will give the proper opportunity for the employment of the superior faculties of high grade students."

A careful study of our marking system was made by a special faculty committee. The report showed certain weaknesses in our present system which it is hoped will be remedied by the detailed plan which the committee was instructed to draw up for adoption by the faculty.

The problem of finding financial aid for deserving students is assuming larger proportions every year. The College has an invested fund the income of which provides for about twenty-three scholarships of $60 each. The Ward fund, administered by its own board of trustees, assisted sixteen students last year. The Crane fund, administered through the Dean's Office, assisted eleven students. At least sixty-four freshmen received sums of money, ranging from $50 to $400 from local organizations, scholarship funds and clubs not under the jurisdiction of the College. Apart from these scholarships which are given to students without any future obligation on their part, a much larger number were assisted through loans either from the College or from outside sources. When one adds to the above the more numerous group made up of those who have working positions in the library, laboratories, dining halls, college barns, offices and in the town, it is evident that the State is providing educational opportunities for a large number of students who could not possibly meet the expenses at privately endowed colleges and universities.

The changed course of study which became effective with the class of 1931 was put into operation with comparatively little administrative difficulty. The social science requirement of the sophomore year increased the teaching load of certain instructors very materially, but a readjustment within the departments has brought the desired relief. The curriculum changes appear to meet with general approval.

The student Senate showed its willingness to cooperate with this office on all matters of mutual concern and as a result, extremely irritating student problems were relatively few this year. Dancing is proving a very popular form of recreation. Both formal and informal dances have increased to the point where immediate steps must be taken to reduce their number. The committee on Student Life is studying this problem and with the cooperation of the Inter-Fraternity Council and student governing organizations, it should be able to effect the much needed change.

Our new five-year building program will help satisfy a real need. When realized, it will make classroom instruction far more effective and administrative work more efficient. However, since this does not include freshman dormitories, it is urgent that immediate steps be taken to secure these. I am convinced that we are not in a position to do full justice to our students until these are available.

The morale of both the students and the faculty has been quite satisfactory and we face the future hopefully.

Wm. L. Machmer,
Dean.

REPORT OF THE DIRECTOR OF THE GRADUATE SCHOOL

At the last Commencement, six advanced degrees were conferred, five being Master of Science and one Doctor of Philosophy.

During the year 1928–29, 99 different graduate students were registered, coming from many institutions in different parts of this country and abroad.

The duties of the Director of the Graduate School are largely routine in their nature, once the scope, policies and organization of the school have been fixed. Yet these duties vary greatly from day to day as each student presents problems which, in almost every case, are individual. Often analysis of the transcript of previous work, which he presents on entering, is of itself no easy task, and the record may reveal conditions elsewhere which had been quite unexpected and

which may lead to the requirement of some undergraduate studies here to place the student on a par with our own graduates.

The determination of prerequisites for major graduate work has been so entirely a matter for the department concerned, until recently, that the Director has never known what was required nor whether the work was completed: a thesis might be nearly ready for presentation without any knowledge of this by the Director; its nature, even, might be entirely unknown to him. These and similar conditions have led to difficulties late in the student's course and, with diverse ideas in different departments as to thesis standards, the results have occasionally been serious. This unfortunate condition has been largely removed, I trust, by plans which have now been in operation for about a year and a half. Under present regulations, no such situation can proceed for long before it is discovered and the proper steps taken to correct it, all of these being such as to produce a smoothly working organization.

A number of questions still need consideration and the formulation of a definite policy. Among these is an interpretation of residence. At each end the meaning of this term is clear, but when a graduate student can be present only a part of a day once a week, the question whether he can be considered as in residence is forced upon the staff of the Graduate School for consideration. Many places giving graduate work accept such an attendance as this as residence. Here it has never been settled except tacitly by permitting such students to continue their work to graduation.

Another question is how much work in absentia may be permitted and what supervision, if any, shall be required for work done under such circumstances. Again no formal action has been taken and, in the absence of any, the Director has ruled that one year in residence is the least which will be required for an advanced degree.

A third problem is that of the degree to confer. Students in Education take work very different from that in Science departments and their theses vary markedly with the type of investigation, collection of data, nature of the conclusions reached, etc. This has been recognized in many places by conferring the degrees Master of Education and Master of Science on these two groups, respectively. The problem is further complicated by the question whether degrees in agricultural and horticultural lines should also be Master of Science. Some Graduate Schools have solved this by naming on the diploma the department in which the major work has been taken, as, for example, "Master of Science in Zoölogy," "Master of Science in Dairy Husbandry," etc. This situation has frequently been discussed by the Graduate Staff but, thus far, no decision has been reached.

Finally, the question as to what should be the scope of a graduate school in an institution of this kind has been raised. Until this has been settled, details such as those already referred to would seem to be of slight relative importance, and the ground to be covered by the Graduate School here should be fixed as soon as possible.

H. T. Fernald,
Director of the Graduate School.

REPORT OF THE DIRECTOR OF SHORT COURSES

Stockbridge Enrollment

Early in the summer it became apparent that students were not applying in as large numbers as in 1928. Final enrollment figures in October showed a drop of nearly 20 per cent in the first year group; (1928) 135, (1929) 110. This decrease in new students was slightly offset by a larger number of seniors returning for the second year. Out of 120 students taking placement training from April to October, 98 returned to complete their class work of the senior year. To this group should be added 9 new men taking the second year courses, making the total senior enrollment 107. Including both classes we have a student body of 217 as compared with 240 for 1928.

Just why this slacking off in attendance should occur this year, after the two previous years of appreciable growth, is difficult to explain. Leading educational

authorities are conceding that the peak of college attendance has passed, as reflected in a reduction of most college registration records for 1928, and apparently the two-year program of work has experienced a similar shrinkage.

Each year a larger number of students are entering the School with credits secured through graduation from a county agricultural school or from a high school department of agriculture. On the basis of this four-year secondary course in agriculture, a student can secure the Stockbridge diploma by completing only the required three terms of the senior year, receiving full credit for the two terms of the first year and the placement training period. As a result of this combined training program, many of the students are securing excellent job opportunities, as, for example; one 1929 graduate is now superintendent of the poultry plant at the University of New Hampshire, while another has charge of the dairy herd at a state hospital in Rhode Island.

Trend in Selection of Majors

Contrasting the selection of major courses of study between the 1928 and 1929 groups of freshmen in the School reveals a marked trend towards Horticulture and considerable curtailment in several other majors.

	Class of 1930 (Placement)	Class of 1931 (Registration)
Division of Agriculture:		
Animal Husbandry	24	24
Poultry Raising	15	9
Dairy Manufactures	13	10
Total for Division	52	43
Division of Horticulture:		
Flower Growing	29	14
Fruit Growing	9	10
Horticulture	27	42
Vegetable Gardening	5	1
Total for Division	70	67

Placement Service

Many new positions had to be secured by Mr. Grayson during the winter and spring of 1929 in order to provide places for students going on their six months placement work. With the help of the various college departments, an adequate supply of training jobs were secured and in the majority of cases they proved to be entirely satisfactory to the students for the type of work they were seeking. Nine girls of this group were placed in positions by Miss Hamlin.

Students were located in nine different states as follows:

Massachusetts	85	New Hampshire	2
Connecticut	12	New Jersey	2
Vermont	3	Maine	2
New York	3	Rhode Island	1
Ohio	1		

Student earnings on placement amounted to more than $45,000.00 for the year.

In employment service rendered to graduates, both of the College and the School of Agriculture, Mr. Grayson's office has made a most encouraging record. In 1928, graduates applying for positions through this service numbered 207, in 1929, 303; positions available, — (1928) 163, (1929) 321; positions secured for suitable candidates, (1928) 72, (1929) 131; total salaries or wages paid in these positions, computed on a yearly basis, (1928) $97,872.00, (1929) $172,690.00. These data are furnished only from reports actually received at the office, while in many other cases positions are filled indirectly, but no notification is sent in and therefore cannot be credited.

Stockbridge Advisory Committee

The faculty advisory committee appointed last spring has proved of great assistance in reorganizing the program of studies in most of the major courses. These changes should result in a better distribution of time allotted to certain subjects by reducing the class hours per week, and thus enabling other courses of definite vocational value to be added to the special curriculums. There is still room for further improvement, but we are much encouraged by the committee's constructive suggestions and the changes ratified by the various departments affected. I wish to record my appreciation of the committee's efforts in this work. I am certain, as a result of the work of this committee, that each department sponsoring a Stockbridge course will feel a keener responsibility for the training value, method of presentation, and content of courses offered.

The Winter School

The greenkeeping course again had an enrollment up to the limit of our facilities and a waiting list for possible vacancies. The College seems to be establishing a reputation for this unique type of specialized training in a field which has not as yet become overcrowded. It does not seem wise to expand this course to take in all who may apply and I feel we are following a safe plan in limiting the enrollment. Total registration of ten weeks' students was 32; in the ten-day courses, 21; compared with 47 and 28 in the respective groups for 1928. For 1930, we are discontinuing the selection of subjects from a long list of courses and plan to offer only special group programs such as "General Farming," "Poultry Raising," "Greenkeeping," and the like. This plan will eliminate classes too small for economical or efficient instruction.

Summer School

With a registration of 152 students, of whom 25 took graduate school courses, we secured about the number to be expected. Education courses again head the list of student selections and an expansion of our offerings in this line seems justified to meet professional improvement requirements for teachers in service. In Home Economics a special advertising program to interest teachers in our work failed to show any marked results. With the limited teacher group to be served in this field, it seems doubtful if we should continue to stress this work quite so much as in the past. Reports from other colleges in this section, making similar offerings, showed a decline in this group of registrations. The science courses continue to attract only limited numbers despite the special advantages offered by both our location and equipment.

Roland H. Verbeck,
Director of Short Courses.

REPORT OF THE LIBRARIAN

There are now in the library system 84,700 catalogued books, about 10,000 uncatalogued, and probably over 50,000 pamphlets, all in such order that they can be readily found when needed. During the year, 2,227 volumes have been catalogued. A notable accomplishment in cataloguing during the past year has been the reclassifying of a considerable part of our collection of general literature so as to avoid confusion and delay long endured by students in finding these books. The number of department libraries is now forty-five; the books in all these being catalogued in the main library so as to unify all book resources of the college.

The number of books loaned out from December 1, 1928 to November 30, 1929 was 9,610; the busiest months being January, April and October, with over 1,200 each. The building was open for study 341 days; fourteen hours each day during week days of regular terms, and five each Sunday. The change of Sunday hours from forenoon to afternoon and evening, made at request of the student body, is apparently considerably more convenient for study.

Over five hundred periodicals are regularly received by the library and kept available for use.

During the year, the faculty committee on the library has been reorganized, being made more than twice as large and more representative of all the interests of the college including the Experiment Station and Extension Service. This has resulted in an increase of efficiency and closer cooperation in serving the widely varied needs of the academic community. Under this new system has been accomplished a long projected and difficult piece of work, the apportionment by departments of our long list of periodicals. This has permitted a reduction of the list, and should bring in the future more faculty cooperation and understanding of our needs, resources and limitations. A reapportionment of the department book funds has been possible, also, and will be a notable help.

Slight rearrangements of the clerical work rooms of the library on each floor have slightly relieved the hard conditions long prevailing, but still leave much to be desired. The prospect of an enlargement of our building brings renewed hope of relief from the long-endured crowding, and for a general forward-looking policy for the library.

The attitude of the student body seems steadily to grow in loyalty, obedience to necessary rules, and appreciation of the service rendered by the library. This has been happily echoed in exhortations to loyalty voluntarily expressed in the student assembly — an encouraging indication of sentiment.

Basil B. Wood,
Librarian.

REPORT OF THE DIRECTOR OF THE EXTENSION SERVICE

Progress can be noted in all activities of the Extension Service during the year 1929; our workers having given service and assistance in nearly every community of the State. In order to do their work effectively, the members of the extension staff have made unusual efforts to develop better teaching methods, and to keep up to date in their subject-matter by following the research studies of experiment stations. They have read the latest books, bulletins, and magazine articles. They have kept in touch with the leading authorities and institutions throughout the United States, and have attended such conferences as would be helpful to their work.

The coordination of the work of each specialist to that of the other members of the staff has been pronounced, and a realization on the part of the extension teacher of the necessity for coordinating his efforts with those of the research worker is more than ever apparent. We have continued our endeavors to strengthen the farmers' educational and business organizations of the State by assisting the secretaries of these organizations in making constructive programs and advising with the executive committees on such subjects as we are in a position to be of service.

The news service of the College under the direction of the extension editor has expanded considerably during the year. More than 500 news items and special articles were sent to the newspapers and agricultural periodicals of the counties and State. The M. A. C. Review, house organ of the College, has been increased about 50 per cent in size, and there has been a proportionate increase in quality, due to the increased interest in this publication on the part of the staff. During the year, 22 of the extension bulletins have been revised and 4 new bulletins written and published. The 4-H news writing contest has been conducted again this past year and an increase of about 25 per cent in the number of reporters has been noted.

Assisting community organizations in program making is being attempted through a publication issued monthly containing hints and suggestions for the use of the secretary or program committee in the development of instruction and entertainment. At the time of the New England Grange Lecturers Conference, and the Northeastern Section of the American Farm Bureau Federation Convention held on the campus, the Extension Service gave every possible assistance in making the local arrangements satisfactory to those attending.

Farm and Home Week was attended by a few more farmers and homemakers than the record attendance of the previous year. Correspondence courses are

announced occasionally and supplied to those desiring them. Radio continues to be an avenue for reaching many people, and with the cooperation of the U. S. Department of Agriculture and the broadcasting stations our specialists were at the microphone 38 times. Thirteen unit exhibits were prepared and used by the county extension services at 89 fairs.

The establishment of the Federal Farm Board, with its program for promoting cooperative marketing and informing growers of the economic influences bearing on the distribution of crops, means that we must add to the efforts that we have been making to promote better marketing and distribution of crops. The marketing program of the Agricultural Committee of the New England Council is receiving our support. Our specialists are cooperating with the representatives of the Massachusetts Department of Agriculture in their educational project to acquaint growers with possibilities of grading to standards and identifying their packs with the New England label.

There has been submitted to the Course of Study Committee of the college a request, with an outline attached, for an undergraduate course for extension workers. The field for extension teachers is permanent and offers good opportunities. Special preparation for this field is becoming more and more necessary as those going into this profession are delayed in their effectiveness due to the lack of knowledge of the economic, social, and political conditions surrounding rural people, and the teaching methods of the extension field. If a general foundation course was available, the extension teacher having had such a training would lose less time in becoming effective after taking a position. New extension teachers are now informed on subject-matter questions, but how to teach adults the principles of farm and home practices is a problem they spend a great deal of valuable time in solving after taking a position. We hope that a course, which will prepare prospective extension workers, can be worked out, and that those taking this course will be so instructed that their services will be more quickly effective after taking a position in our state and county Extension Service.

The plan adopted by the College which includes opportunity for professional improvement of our specialist staff will be very helpful in making their services more valuable to the State, and I look for several to take advantage of this opportunity as soon as they have been members of the staff sufficiently long to become eligible. A committee is now formulating a report which will seek to extend the opportunity for professional improvement to the members of the county services.

The resident staff of the College has given its best cooperation in accepting engagements to meet with groups of farmers and homemakers whenever they could supplement the work of the extension specialists. There have been times when it has been impossible for the extension specialist to meet all requests.

The few changes which have taken place in the personnel of the staff have marked a low record for the Massachusetts Extension Service. One club agent and one home demonstration agent resigned during the year. There have been added to the Service a specialist in child development, one assistant county agricultural agent, eight club workers, and one assistant home demonstration agent. For several months, we have been endeavoring to find a specialist in plant pathology to fill the position which was established in that subject, and not until November 25th were we able to recommend the appointment of Dr. O. C. Boyd to take the position on January 1, 1930.

Following closely the work of the members of the extension staff, one is impressed by the fact that every branch of agriculture and country life is somewhere influenced and assisted by this service to rural people. Only a few of the striking examples will be mentioned in the following paragraphs:

Agronomy

Pasture improvement, through the use of fertilizers, has been demonstrated by 47 farmers who have been able to keep records and show an increased yield of feed. Demonstrations have been started in the grazing of mowings, and sweet clover pastures have increased in acreage and quality. These demonstrations have been used as places for field meetings where farmers could see the results

and discuss the value of top dressing pastures and using grazing lands for pasturage. Although the season was dry, a satisfactory number of farmers registered in the 300 Bushel Potato Club again, the highest yield reported being 415 bushels per acre.

Animal Husbandry

Additional members have been added to the 12 established dairy herd improvement associations. These associations have broadened their influence this year by inviting in many non-members to their meetings. The records of the members of the association have been used as teaching material, and letters and news articles were distributed so that many dairymen of the State have benefited by the systematic work of the 300 farmers belonging to the associations. About 1,000 farmers receive a news letter containing information of a helpful nature to dairymen, and many of these letters are published in the county papers.

The State Department of Agriculture and the Division of Animal Industry have been assisted wherever we could do educational work that would improve the milk supply and in the campaign for the eradication of tuberculosis among dairy cattle. The specialist has assisted the Massachusetts Dairymen's Association in making its programs for the several meetings which it has held. He has also conducted the dynamometer contest at the fairs this fall, and as time permitted, he has acted as judge of dairy animals.

Farm Management and Agricultural Economics

In order to secure facts upon which a market gardening program could be based, the specialists in economics and farm management were requested to visit a large number of market gardens in order to obtain the necessary information. About 125 records were secured on various phases of the market garden business, and also 40 production cost records on 10 different vegetable crops were obtained. At the same time, a study has been made of the factors influencing the distribution of these crops in the markets. The results of these studies are now being prepared for presentation to the county agents and to the members of the market garden industry, and from them they will determine a program which will work toward the improvement of the market garden business. The specialists in these two fields have been endeavoring to spread the use of the National and New England Outlook Reports by first presenting the facts of the outlook by the use of charts to the agricultural specialists, then to the county agents, and as the county agents arranged meetings of farmers, they have presented the facts at these meetings. There was also distributed 10,000 copies of the New England Outlook Report, which many papers and publications reprinted. A publication under the name of Economics Facts has been issued monthly, and 9,000 copies were mailed during the year. Further, to spread economic information, ten broadcasts over the radio have been made. Farmers' cooperative marketing associations have been receiving services whenever opportunity offered.

Pomology

To magnify the importance of fruit free from insect and disease injury, an endeavor was made this year to launch a 90 per cent Free From Disease and Insect Injuries Apple Club. Two hundred ten growers throughout the State signed up in this club, and at the end of the season 70 believed they had crops clean enough to apply for a check-up. Fourteen with crops of 100 barrels or more made the final goal of a 90 per cent clean apple crop. The problem of proper pollination has been faced, and beekeepers of the State have been prepared to assist by furnishing colonies to fruit growers. Also, many package lots of bees have been purchased by fruit growers, and in many instances, full hives.

Storage and Food Preservation

Fifty-seven fruit and vegetable storages have been designed during the year, many of which have been used as demonstrations where others contemplating storage construction could get assistance. The food preservation specialist has

carried on meetings where leaders were trained who in turn taught groups of people in their local communities. The Massachusetts Fruit Growers' Association was assisted by the specialist in arranging its programs and in conducting its meetings. In addition to his regular work, he has also had charge of our radio broadcasting program.

Vegetable Gardening

This year has seen much progress in grading vegetables to state established standards. Improvements can be noted in the packages and in the methods of packing our vegetables in the larger markets. The use of parchment paper in wrapping celery has come about in the last three years through the efforts of the extension specialist in market gardening. He has also assisted the market gardeners in their program for distribution of lettuce, cucumber, and carrot seeds of high grade quality. In 1929 enough carrot seed of this quality was distributed to produce over a hundred thousand bushels, and the test of this seed indicates an average yield of 35 per cent over any other.

Poultry

The Massachusetts Experiment Station developed an effective vaccine for immunizing poultry against pox. The educational campaign which has been carried on relative to the value and use of this vaccine has resulted in the vaccination of thousands of birds. At the College, a three-day Poultry Breeding School, which was a continuation of the one held last year, brought an enrollment of 150 poultrymen. The program for a standard grading of market eggs has made headway. About 100 producers have made application and have secured permission to use the State Department of Agriculture label designating high quality eggs.

Forestry

Demonstration meetings for lumbermen and farmers have been held at saw mills where samples have been shown of small logs cut with a large percentage of waste compared with large logs which cut to much better advantage. At these meetings the piles of logs at the mill yards were studied and estimates made of the waste incurred through the cutting of immature timber. These demonstrations have been supplemented by wood-lot meetings where illustrations of thinning and release cutting for the encouragement of natural growth have been observed.

4-H Club Work

Through the increase in the number of 4-H club agents, we are noticing an improvement in the boys' and girls' work. In every county except Essex and Dukes, there are now two or more agents, each of these two counties having one for both boys and girls. The state-wide cotton school dress contest aroused wide interest in school dresses of character and style. The winner goes to Chicago for the National Boys' and Girls' 4-H Congress held in December. The food project has been carried into every county doing 4-H club work. The hot school lunch has been extended into more rural schools and an extensive program of health work has also been initiated.

In the counties, more training schools for club leaders have been conducted this year than ever before and their effect upon the work of the club members is being noted. The increase in club workers made it possible to conduct more club camps in the counties for club members than in any previous year. At one camp, local leaders were given the opportunity to enjoy a few days vacation and at the same time secure additional training as local leaders. This year, for the first time, two counties have made plans, and have them under way, for an organization of county local leaders. The purpose of this organization is to furnish voluntary help to the county club agents in promoting and strengthening 4-H club work.

The county club agents interested in forestry have been given the opportunity to attend two training schools in forestry during the year. In the dairy work, a team of three club boys was selected through county and state judging contests to be sent to St. Louis to demonstrate and judge at the National Dairy Show.

Probably one of the outstanding and growing achievements is the increased interest among local leaders of 4-H clubs who have been privileged to attend the local leaders' training school at Camp Gilbert. For the first time, all the county club agents have made programs of work for the future development of club work in their respective counties. This has been done with the cooperation of the agents from the state office. The adherence to these programs will give a more progressive development for club work at a minimum expenditure of money and effort.

Home Economics

There are three things which emphasize the progress made:

(1) Three times as many young mothers are found in our groups of women as in previous years.
(2) Twice as many homemakers have accepted the responsibility of leadership in organizing and teaching community groups.
(3) A definite start has been made in two counties for gathering necessary facts upon which to base the home economics program.

Child Development and Parent Education

The child development and parent education project has started with unusual interest. Immediately, upon the arrival of the child development specialist, opportunity for being of service to the county extension services and to many groups of mothers came to her. She hardly had time to make plans and prepare for an extensive teaching program before she had to start to meet the groups of mothers waiting for her. The specialist has endeavored to instruct the home demonstration agents so they can be helpful in promoting the child development program, and she has instructed many parents on some of the fundamental principles of child development so that they in turn are passing along the information which she is giving to them.

Clothing

The clothing specialist has made studies in order to determine what are the real needs of the groups in clothing instruction, and as a result of this she is giving a program of instruction which is suited to the means of those whom she is teaching. In one county, a group organized on a community basis presented themselves at their first subject-matter conference and reported nine groups organized to take instructions from trained leaders. In another county, the garment finish project was developed on the leader basis with 41 chief leaders from 20 communities teaching 62 local leaders who in turn taught 700 women and reached over 1,500 other women.

Nutrition

In this project, we also note in the groups a large increase in the number of mothers with young children. This is due to the emphasis placed on the child feeding subjects by the state leader, the extension specialist, and the home demonstration agents. These young mothers are in turn leading groups of neighbors and giving them the information that they secure at the leader training meetings. There is developing a nutrition consciousness in most of the communities in which the nutrition specialist is working. Instead of stress being placed upon fancy cooking, the women as a whole are interested in the nutritive value of foods and the best methods of preparation from the point of view of the health of the family.

Home Management

This project is attracting more young homemakers and is being appreciated by the home demonstration agents in the several counties for its wider value and for its importance to the satisfaction of home life. More local leaders are volunteering to instruct groups of neighbors and this is due in part to the confidence which has been gained through their contact with the extension organization and also to a realization, on the part of homemakers, of their responsibility to the

women of their respective communities who are eager and desire home management instruction. With one exception, every county in the State has carried on one or more phases of this project and this county now has plans under way for beginning.

Relationships

Cooperation with federal and state agencies having interests in extension teaching continues to be of the best, as does that with state, county, and local organizations carrying on activities pertaining to the problems of the farm and the home.

WILLARD A. MUNSON,
Director of the Extension Service.

REPORT OF THE DIRECTOR OF THE EXPERIMENT STATION

For the year ending November 30, 1929, there have been practically no changes in the staff nor in the organization of the activities in the Experiment Station. In general, work previously in progress was continued, and since results under the various projects will be submitted in the Director's annual report of the Experiment Station, this statement will concern itself only with new activities and developments. Because of the rather strained economic conditions confronting agriculture, a very definite effort was made to direct certain investigations so as to make available for immediate use such results as might prove most serviceable to certain phases of the industry.

In this connection, special consideration was given to the problems of the onion grower in the Connecticut Valley in the expectation that, through improved culture, more adequate methods of disease and pest control, and the development of more desirable varieties or strains, a product might be produced that will reach the market in a condition and at a time when competition from other sources is less pronounced. It is intended in the future to direct similar intensive study to the production of tobacco, fruit, truck and dairy products in the hope that local products will, because of quality, find a recognized and more unchallenged place on the market. Since Massachusetts and most of New England is more favored by good market conditions than perhaps any other section of the United States, it would seem ill-advised to promote the production of kinds and qualities of agricultural produce wherein proximity to market and special merit of product are not very prominent factors.

To develop the type of investigation which will give the suggested consideration to local market conditions will require the promotion of cooperation between several departments which at present are attempting to deal more or less independently with the problems of the grower. This cooperation should influence especially the work in farm management and agricultural economics and furnish an incentive to carry the activities of these departments beyond the survey stage. While farm management and economic surveys may be essential and fundamental, they serve best as a means to the greater end arrived at only after a direct application is made through correlation with the findings from research in some production department. The favored market conditions in New England for many agricultural products supplies further encouragement for investigational effort in this field where economics of the industry are such a prominent factor.

At the Cranberry Substation at East Wareham, there is a need for much fundamental study pertaining to natural or artificial factors determining quality in the cranberry crop. To satisfy the demand for this service, the Station was fortunate to enlist, during the summer months of 1929, the help of Dr. William H. Sawyer, Jr. Dr. Sawyer devoted the major portion of his time to determining the pH value of the foliage of several varieties as influenced by variations of temperature, light, etc. Also an effort was made to put to practical use, through proper dissemination of the organisms, such fungi as are known to attack certain insects which need to be controlled.

In the past the demand for information on the part of the cranberry grower was of such a nature that most of the investigational work was directed toward disease and pest control and quantity production. The time is now here when

more attention should be given to studies influencing quality of product, and the inauguration of such a program will mean considerable change in the physical equipment — a matter requiring careful consideration.

During the last two years, the Farm Department, in cooperation with other departments in the Division of Agriculture and with the Synthetic Nitrogen Products Corporation of New York City, conducted a study of a method of intensive pasture management, commonly known as the Hohenheim System. This work was primarily intended to be of a demonstrational nature and therefore received no direct financial support from the Experiment Station other than the limited personal service of a few of the staff members. The results of this project, after two seasons' work, show evidence that the plan as outlined, with some slight modifications, offers a very fertile field for investigation, and it is the hope to give rather substantial financial Experiment Station support to this project in the future. A program of pasture improvement which gives indications of economically increasing the carrying capacity of much land in Massachusetts now in rather unsatisfactory condition should be received with enthusiasm in a section where high grade dairy products find as ready a demand as in New England.

There is a strong demand for research regarding various commercial products, the sale of which industrial concerns are contemplating to promote on the basis of merit as determined by investigation. Since adequate funds are not available for this type of service, several studies are now in progress the support for which comes in large part or entirely from private sources. It is recognized that the wisdom of accepting such funds may be questioned. For this reason the administration has adopted the policy of accepting private support for research only where the interest in the results from the investigation is not in conflict with the service for which the Experiment Station was primarily established and for which public support can be justified. A discriminating selection of this type of financial support is making it possible to extend the scope of service without danger of lessening its quality.

With the rapid changes taking place in the entire agricultural industry, there is an increasing demand for service regarding the merits of new practices. In the past, while there was still a regular annual increase of $10,000 of Federal Purnell support, the Experiment Station was enabled to slightly enlarge its program from year to year and thus to meet the urgent requests for service in these new fields. Since Purnell support reached its maximum of $60,000 on July 1, 1929, and no further immediate increase can be expected from this source, it will be necessary to make provision for larger state support from year to year if these requests are to be adequately met.

That the general public is appreciative of the service of the Experiment Station and willing to extend the opportunities for its activities was evidenced by a recent action of the State Legislature in providing special funds for research in the field of floriculture. The initiative for this action was supplied by the floricultural interests on the basis that they felt justified in demanding for this industry a service similar to that which is being rendered to the market gardeners. While this reaction is in itself a distinct compliment to the investigator, it took tangible form in a bill enacted providing an appropriation of $15,000 for extra greenhouse space and other equipment, and the additional service of two men trained for investigational work in this field. This action will greatly enlarge the activities of the Market Garden Field Station at Waltham because the entire expenditure of funds and service will be directed through and from this Station.

The gradual promotion in salary of the worthy members of our staff is not only good administration, but is consistent with the apparent intentions as laid down in the provisions of the salary scale under which the institution operates. Nevertheless, these increases have brought many of our best workers so near the maximum salary for their classification that their future in this respect is becoming decidedly circumscribed. Strong and ambitious workers in full realization of this condition will either remain with us and have their ardor dampened by this limitation in promotion, or otherwise they will seek positions elsewhere. It would seem essential to our own welfare, therefore, if we are to maintain the high standard that Massa-

chusetts holds and deserves in this field, that a thorough survey of salary conditions in other comparable institutions and fields be made in order to make sure that an arbitrary salary scale, that may have been adequate in the past, may not be operating to our disadvantage at present or in the future. It is recommended that a thorough study of our salary scale receive most earnest and early consideration.

F. J. Sievers,
Director of the Experiment Station.

REPORT OF THE TREASURER

There is herewith submitted the annual report of the Treasurer for the fiscal year ending November 30, 1929.

The State appropriation for current expenses was $992,910.00, a balance brought forward from the previous year amounted to $12,476.86, making the total amount available for the year, $1,005,386.86. Our expenditures for the year amounted to $985,988.67; bills in transit and supplies contracted for, including coal necessary to carry the Institution to April 1, 1930, aggregate $18,824.25. This, plus our actual disbursements, amounts to $1,004,812.92, which leaves a net balance of $573.94 to be turned back to the State Treasurer.

The Federal Government appropriation for our fiscal year amounts to $183,019.56. We brought forward a balance of $51,264.86, which made a total of $234,284.42 available; there was expended an amount of $186,909.17, leaving a balance of $47,375.25 to be expended during the first six months of 1930. A complete statement of both State and Federal Funds follows:

	State	Federal	Total Appropriation	Expenditures
College	$627,311 26	$67,817 73	$695,128 99	$658,260 23
Experiment Station	98,624 45	93,680 09	192,304 54	180,982 24
Extension Service	96,637 92	72,786 60	169,424 52	156,061 16
Short Courses	74,186 15	–	74,186 15	70,266 06
Market Garden Field Station	13,025 03	–	13,025 03	12,884 59
Control Laws	71,284 34	–	71,284 34	70,483 72
Trustees' Travel	1,345 83	–	1,345 83	1,029 28
Printing Reports	2,374 68	–	2,374 68	1,150 59
Replacements	20,597 20	–	20,597 20	21,779 97
Totals	$1,005,386 86	$234,284 42	$1,239,671 28	$1,172,897 84

The State made an appropriation of $127,916.92 for special projects. There was a balance of $14,463.35 brought forward from the previous year's projects which made the total amount available, $142,380.27. There was expended $50,367.90; there was also an amount of $11,746.08 that reverted to the State Treasurer on the 1928 appropriation, leaving a balance of $80,266.29 to be expended during 1930. This is made up as follows:

	Appropriation	Expenditures	Balances
Horticultural Manufacturing Building	$69,966 92	$15,211 14	$54,755 78
Emergency Needs	5,000 00	2,383 30	2,616 70
Abattoir	14,000 00	8,695 27	5,304 73
Renovation Dairy Laboratory	4,000 00	–	4,000 00
Garage for six cars	2,500 00	2,372 87	127 13
Road Construction	10,000 00	9,962 49	37 51
Poultry House and Hot Water Brooder	2,050 00	1,404 22	645 78
Renovation Brooks Farm Barn	5,400 00	5,161 81	238 19
Market Garden Field Station Improvements	15,000 00	2,459 53	12,540 47
	$127,916 92	$47,650 63	$80,266 29

The receipts of the Institution were $271,850.19, an increase of $27,404.41 over those of the last fiscal year. A comparison of the two years is as follows:

	Receipts, 1929	Receipts, 1928
College	$146,324 83	$139,734 89
Experiment Station	24,674 31	21,916 15
Extension Service	824 81	816 33
Short Courses	17,796 80	16,343 71
Market Garden Field Station	272 47	519 86
Control Laws	81,956 97	65,114 84
	$271,850 19	$244,445 78

Inventory for the plant shows a value of $2,817,730.83, an increase of $40,302.43 over preceding year.

Trust fund accounts have increased $3,000.00. This was a gift from the Massachusetts State Federation of Women's Clubs to be known as the Helen A. Whittier Scholarship Fund. The investment of this fund was not completed until the early part of December, 1929, and is not included in this report.

The examination of the accounts of the Institution for the period from December 1, 1927, to November 30, 1928, was made by the Department of the State Auditor. The examination for 1929 will be made at the earliest possible time.

A complete detail of all receipts and expenditures follows.

Fred C. Kenney,
Treasurer.

STATISTICAL REPORT OF THE TREASURER

For the Fiscal Year ending November 30, 1929

Balance Sheet

1928		Debit	Credit
Dec. 1.	To balance on hand	$51,264 86	
1929			
Nov. 30.	To departmental income	271,850 19	
Nov. 30.	To receipts from State Treasurer	786,549 88	
Nov. 30.	To receipts from United States Treasurer	178,929 59	
Nov. 30.	To bills paid by State Treasurer	255,057 14	
Nov. 30.	Refunds transferred to State Treasurer		$1,160 48
Nov. 30.	Expenditures for fiscal year		1,223,265 74
Nov. 30.	Income transferred to State Treasurer		271,850 19
Nov. 30.	Balance on hand		47,375 25
		$1,543,651 66	$1,543,651 66

Statement of Legislative Apportionment and Expenditures for Fiscal Year ending November 30, 1929, and Apportionment requested for 1930

	Apportionment for Last Fiscal Year		Expenditures		Requested Apportionment for New Fiscal Year	
College:						
Personal Service	$443,623 07		$442,902 82		$463,410 00	
Maintenance	183,688 19		170,634 11		185,300 00	
		$627,311 26		$613,536 93		$648,710 00
Experiment Station:						
Personal Service	$79,200 00		$78,180 76		$89,310 00	
Maintenance	19,424 45		20,511 77		20,085 00	
		98,624 45		98,692 53		109,395 00
Extension Service:						
Personal Service	$60,137 92		$58,849 83		$67,035 00	
Maintenance	36,500 00		37,315 17		40,100 00	
		96,637 92		96,165 00		107,135 00
Short Courses:						
Personal Service	$63,000 00		$59,221 50		$60,320 00	
Maintenance	11,186 15		11,044 56		12,400 00	
		74,186 15		70,266 06		72,720 00
Market Garden Field Station:						
Personal Service	$7,700 00		$7,994 87		$8,600 00	
Maintenance	5,325 03		4,889 72		6,500 00	
		13,025 03		12,884 59		15,100 00
Trustees' Travel	$1,345 83		$1,029 28		$1,200 00	
Printing Reports	2,374 68		1,150 59		1,500 00	
Replacements	20,597 20		21,779 97		20,000 00	
		24,317 71		23,959 84		22,700 00
Feed Law	$11,016 12		$10,949 10		$11,000 00	
Fertilizer Law	13,800 00		13,807 52		14,100 00	
Milk Testing Law	1,105 95		952 94		1,500 00	
Poultry Disease Law	34,900 76		34,624 95		37,500 00	
Seed Control Law	4,971 51		4,698 40		5,500 00	
Laboratory Service	5,490 00		5,450 81		5,640 00	
Totals		71,284 34		70,483 72		75,240 00
Emergency	$5,000 00	5,000 00	$2,383 30	2,383 30	$5,000 00	5,000 00
Totals		$1,010,386 86		$988,371 97		$1,056,000 00
Balance unexpended				22,014 89		
				$1,010,386 86		

Cash Statement

	Other Funds	State Funds	Totals
Balance December 1, 1928	$51,264 86	–	$51,264 86
Receipts			
College receipts from students and others	–	–	65,115 70
Tuition	–	$37,763 00	–
Laboratory fees	–	6,033 13	–
Rent	–	21,319 57	–
Department Sales	–	–	81,209 13
Products	–	67,607 74	–
Miscellaneous	–	13,601 39	–
Experiment Station	–	–	23,422 21
Cranberry receipts	–	6,875 83	–
Chemical receipts	–	429 60	–
Miscellaneous	–	16,116 78	–
Extension Service	–	–	824 81
Correspondence	–	581 10	–
Miscellaneous	–	243 71	–
Short Courses	–	–	17,796 80
Student fees	–	17,196 75	–
Winter School	–	592 00	–
Miscellaneous	–	8 05	–
Market Garden Field Station	–	–	272 47
Produce	–	272 47	–
Feed Law	–	20,060 90	20,060 90

	Other Funds	State Funds	Totals
Fertilizer Law	–	$16,157 74	$16,157 74
Milk Testing Law	–	1,020 72	1,020 72
Poultry Disease Law	–	44,547 31	44,547 31
Seed Control Law	–	170 30	170 30
Laboratory Service	–	–	1,252 10
Bacteriology	–	766 10	–
Pathology	–	486 00	–
Treasurer of the Commonwealth	–	–	786,549 88
Maintenance	–	769,633 50	–
Special appropriations	–	12,826 41	–
Endowment	$1,959 97	–	–
Smith-Hughes Fund	2,130 00	–	–
Federal Government	–	–	178,929 59
Land Grant of 1862	7,300 00	–	–
Hatch Fund of 1887	15,000 00	–	–
Morrill Fund of 1890	16,666 67	–	–
Adams Fund of 1906	15,000 00	–	–
Nelson Fund of 1907	16,666 66	–	–
Smith Lever Fund of 1914	32,316 26	–	–
Purnell Fund of 1925	55,000 00	–	–
Capper Ketchum Fund of 1928	20,980 00	–	–
Bills paid by State Treasurer	–	255,057 14	255,057 14
	$234,284 42	$1,309,367 24	$1,543,651 66

Payments

	Other Funds	State Funds	Totals
College Expenses	–	–	$658,260 23
Personal Service	$44,723 30	$442,902 82	–
Maintenance	–	170,634 11	–
Experiment Station	–	–	180,982 24
Personal Service	76,321 04	78,180 76	–
Maintenance	5,968 67	20,511 77	–
Extension Service	–	–	156,061 16
Personal Service	57,662 65	58,849 83	–
Maintenance	2,233 51	37,315 17	–
Short Courses	–	–	70,266 06
Personal Service	–	59,221 50	–
Maintenance	–	11,044 56	–
Market Garden Field Station	–	–	12,884 59
Personal Service	–	7,994 87	–
Maintenance	–	4,889 72	–
Trustees' Travel	–	1,029 28	1,029 28
Printing Reports	–	1,150 59	1,150 59
Replacements	–	21,779 97	21,779 97
Commercial Feedstuffs	–	10,949 10	10,949 10
Fertilizer Law	–	13,807 52	13,807 52
Milk Testing Law	–	952 94	952 94
Poultry Disease Law	–	34,624 95	34,624 95
Seed Control Law	–	4,698 40	4,698 40
Laboratory Service	–	–	5,450 81
Bacteriology	–	2,736 37	–
Pathology	–	2,714 44	–
Special appropriations	–	–	50,367 90
1928 Emergency Needs	–	374 92	–
1928 Renovation of Farmhouse	–	1,758 78	–
1928 Refrigeration Fisher Laboratory	–	633 38	–
1928 Equipment Power Plant	–	49 81	–
1929 Horticultural Manufactures Building	–	15,211 14	–

Special appropriations — *Concluded*	Other Funds	State Funds	Totals
1929 Emergency Needs	–	$2,383 30	–
1929 Abattoir for Animal Husbandry	–	8,695 27	–
1929 Garage Construction	–	2,372 87	–
1929 Roads Construction	–	9,962 49	–
1929 Poultry House and Hot Water Brooder	–	1,404 22	–
1929 Renovation Brooks Farm Barn	–	5,161 81	–
1929 Greenhouses, Market Garden Field Station	–	2,459 53	–
Income	–	271,850 19	$271,850 19
Refunds to State Treasurer	–	1,160 48	1,160 48
Balance	$47,375 25	–	47,375 25
	$234,284 42	$1,309,367 24	$1,543,651 66

Budget Appropriation for Current Expenses for Year Ending November 30, 1929

Personal Services:	Appropriation	Current Year	Balance
Administration	$41,300 00	$41,492 16	—$192 16
Instruction	228,000 00	226,785 53	1,214 47
Maintenance:			
Departmental	81,323 07	70,387 26	10,935 81
Farm	31,000 00	29,304 17	1,695 83
Operating	42,000 00	53,074 13	—11,074 13
Repairs, Ordinary	20,000 00	21,859 57	—1,859 57
Replacements	1,000 00	1,933 66	—933 66
Experiment Station	79,200 00	78,180 76	1,019 24
Fertilizer Control Law	10,500 00	10,890 56	—390 56
Poultry Disease Law	21,000 00	19,167 52	1,832 48
Milk Testing Inspection Law	480 00	481 60	—1 60
Commercial Feedstuffs	9,000 00	8,725 15	274 85
Extension Service	60,137 92	58,849 83	1,288 09
Market Garden Field Station	7,700 00	7,994 87	—294 87
Short Courses	63,000 00	59,221 50	3,778 50
Seed Control Work	3,720 00	3,734 14	—14 14
Laboratory Service	4,890 00	4,939 20	—49 20
Total Personal Services	$704,250 99	$697,021 61	$7,229 38
Travel	$6,058 01	$6,231 77	—$173 76
Office and other Expenses	37,342 95	34,356 42	2,986 53
Teaching and Laboratory Supplies	56,205 72	54,418 10	1,787 62
Minor Equipment	6,807 06	9,723 95	—2,916 89
Experiment Station:			
Supplies and Equipment	14,417 50	16,709 64	—2,292 14
Travel	3,500 00	2,461 02	1,038 98
Office Expenses	1,506 95	1,341 11	165 84
Extension Services:			
Supplies and Equipment	15,500 00	17,066 89	—1,566 89
Travel	21,000 00	20,248 28	751 72
Market Garden Field Station	5,325 03	4,889 72	435 31
Short Courses:			
Travel	1,600 00	1,624 45	—24 45
Office and other Expenses	9,586 15	9,420 11	166 04
Heat, Light and Power	63,236 33	47,284 31	15,952 02
Farm	38 12	—1,596 04	1,634 16
Repairs, Ordinary	14,000 00	20,215 60	—6,215 60
Replacements	19,597 20	19,846 31	—249 11

	Appropriation	Current Year	Balance
Fertilizer Control Law:			
Travel	$1,300 00	$1,214 97	$85 03
Office and other Expenses	2,000 00	1,701 99	298 01
Poultry Disease Law:			
Travel	5,400 00	2,827 24	2,572 76
Office and other Expenses	8,500 76	12,630 19	—4,129 43
Milk Testing Inspection Law:			
Travel	250 00	376 42	—126 42
Office and other Expenses	375 95	94 92	281 03
Trustees' Expenses	1,345 83	1,029 28	316 55
Printing Reports	2,374 68	1,150 59	1,224 09
Commercial Feedstuffs:			
Travel	700 00	541 79	158 21
Office and other Expenses	1,316 12	1,682 16	—366 04
Seed Law (Office and other Expenses)	1,251 51	898 11	353 40
Travel	–	66 15	—66 15
Laboratory Service	600 00	511 61	88 39
Sub-total	$301,135 87	$288,967 06	$12,168 81
Totals	$1,005,386 86	$985,988 67	$19,398 19
College Department:			
Dean's Office	$12,675 77	$13,002 04	—$326 27
Executive Order	11,022 73	10,730 41	292 32
President's Office	19,267 97	19,050 25	217 72
Treasurer's Office	20,624 19	20,661 04	—36 85
Agricultural Economics	9,550 00	9,575 20	—25 20
Agricultural Education	7,850 03	7,804 39	45 64
Agronomy	5,970 15	6,069 95	—99 80
Animal Husbandry	5,023 59	4,791 11	232 48
Beekeeping	2,469 44	2,448 00	21 44
Botany	13,854 85	13,921 25	—66 40
Chemistry	21,490 00	21,616 55	126 55
Dairying	48,828 75	48,374 44	454 31
Economics, History and Sociology	7,336 57	7,311 37	25 20
Entomology	11,410 19	11,303 15	107 04
Farm	36,139 51	34,743 43	1,396 08
Farm Management	5,717 50	5,741 57	—24 07
Floriculture	11,120 22	11,099 12	21 10
Forestry	2,580 00	2,553 84	26 16
Freshman Agriculture	1,345 00	1,350 03	—5 03
General Agriculture	4,218 66	4,565 42	—346 76
General Expense	126 87	9,704 54	—9,577 67
General Horticulture	19,827 31	20,595 29	—767 98
Graduate School	100 00	68 56	31 44
Grounds	10,400 00	10,557 04	—157 04
Horticultural Manufactures	7,009 54	7,011 45	—1 91
Hospital	4,318 12	5,468 77	—1,150 65
Landscape Gardening	7,841 16	7,836 74	4 42
Language and Literature	21,288 92	21,318 38	—29 46
Library	17,819 44	17,689 79	129 65
Mathematics	7,187 50	7,147 80	39 70
Microbiology	12,310 00	12,504 92	—194 92
Military Science	2,673 69	2,633 52	40 17
Mount Toby	2,503 07	2,888 45	—385 38
Physical Education	15,627 41	16,883 88	—1,256 47
Physics	6,170 69	6,193 69	—23 00
Operating and Maintenance	170,921 40	148,217 90	22,703 50

College Department — *Concluded*	Appropriation	Current Year	Balance
Pomology	$12,402 06	$12,393 08	$8 98
Poultry	25,775 80	25,601 01	174 79
Rural Engineering	5,015 00	5,068 28	—53 28
Rural Home Life	13,551 18	13,979 50	—428 32
Vegetable Gardening	8,197 23	8,468 06	—270 83
Veterinary	4,940 00	3,922 77	1,017 23
Women's Dormitory	4,438 00	4,657 24	—219 24
Zoölogy and Geology	4,970 00	4,877 09	92 91
Salary Surplus	1,022 31	–	1,022 31
	$644,931 82	$632,400 31	$12,531 51
Experiment Station Department:			
Administration	$10,270 74	$10,203 89	$66 85
Agricultural Economics	150 00	129 04	20 96
Agricultural Engineering	944 10	943 06	1 04
Agronomy	5,713 40	5,759 11	—45 71
Botany	10,690 00	10,456 42	233 58
Chemistry	14,246 00	13,720 05	525 95
Cranberry	11,060 00	11,288 49	—228 49
Dairy Manufactures	850 00	845 16	4 84
Entomology	8,390 00	8,224 51	165 49
Farm Management	375 00	376 63	—1 63
Freight and Express	300 00	231 96	68 04
Library	350 00	348 36	1 64
Landscape Gardening	100 00	100 13	— 13
Laboratory Service	5,490 00	5,450 81	39 19
Market Garden Field Station	2,955 00	2,955 00	–
Meteorology	600 00	600 00	–
Microbiology	880 00	874 84	5 16
Pomology	8,283 82	8,094 18	189 64
Poultry	9,932 78	9,896 89	35 89
Station Service	14,931 34	15,380 26	—448 92
Veterinary Science	750 00	749 53	47
Fertilizer Control Law	13,800 00	13,807 52	—7 52
Poultry Disease Law	34,900 76	34,624 95	275 81
Milk Testing Inspection Law	1,105 95	952 94	153 01
Commercial Feedstuffs	11,016 12	10,949 10	67 02
Seed Law	4,971 51	4,698 40	273 11
Salary Surplus	—607 27	–	—607 27
Vegetable Gardening	200 00	195 43	4 57
	$172,649 25	$171,856 66	$792 59
Extension Service Department:			
Administration	$16,332 82	$18,298 45	—$1,965 63
Animal Husbandry	2,944 05	2,682 88	261 17
Clothing	3,283 92	3,642 31	—358 39
Co-op Marketing	4,672 94	4,576 50	96 44
Correspondence Courses	1,497 79	1,373 85	123 94
County Agents	3,632 01	3,282 65	349 36
Crop Protection	36 70	21 37	15 33
Dairying	100 00	27 89	72 11
Exhibits	2,011 77	2,023 76	—11 99
Extension Courses at College	4,135 72	3,869 11	266 61
Child Development	522 74	1,115 76	—593 02
Farm Management	3,661 34	3,769 66	—108 32
Forestry	109 67	26 32	83 35

Extension Service Department — *Concluded*	Appropriation	Current Year	Balance
Gardening	$2,565 71	$2,836 57	—$270 86
Home Demonstrations	4,939 87	4,343 68	596 19
Horticultural Manufactures	4,013 92	3,961 62	52 30
Household Management	3,301 70	3,326 85	—25 15
Junior Extension	13,626 46	13,805 48	—179 02
Landscape Gardening	50 00	16 60	33 40
Lectures	87 60	191 12	—103 52
Nutrition	4,298 95	3,617 70	681 25
Pomology	3,620 75	3,545 17	75 58
Poultry Husbandry	4,142 73	4,327 99	—185 26
Printing	7,506 78	7,672 88	—166 10
Rural Engineering	25 00	36 35	—11 35
Soils and Crops	4,465 07	4,008 66	456 41
Salary Surplus	1,288 09	–	1,288 09
	$96,874 10	$96,401 18	$472 92
Short Courses Department:			
Agricultural Economics	$2,125 00	$2,141 70	—$16 70
Agronomy	3,795 84	3,788 01	7 83
Animal Husbandry	3,483 55	3,424 02	59 53
Dairying	5,070 00	5,027 42	42 58
Entomology	50 00	88 67	—38 67
Farm Management	1,567 50	1,569 17	—1 67
Floriculture	2,550 00	2,520 09	29 91
Forestry	27 43	25 87	1 56
General Horticulture	4,015 67	4,061 68	—46 01
Home Economics	1,564 89	1,588 93	—24 04
Horticultural Manufactures	426 95	420 47	6 48
Library	50 00	27 89	22 11
Microbiology	2,498 11	2,441 10	57 01
Office	23,625 68	23,685 33	—59 65
Physical Education	2,073 43	2,086 62	—13 19
Pomology	6,793 16	6,795 35	—2 19
Poultry	2,425 00	2,419 23	5 77
Agricultural Engineering	5,965 44	5,936 88	28 56
Treasurer's Office	200 00	142 47	57 53
Vegetable Gardening	2,100 00	2,075 16	24 84
Salary Surplus	3,778 50	–	3,778 50
	$74,186 15	$70,266 06	$3,920 09
Market Garden Field Station	13,025 03	12,884 59	140 44
Trustees' Expenses	1,345 83	1,029 28	316 55
Printing Reports	2,374 68	1,150 59	1,224 09
Sub-total	$90,931 69	$85,330 52	$5,601 17
Grand Total Maintenance Appropriation	$1,005,386 86	$985,988 67	$19,398 19

Special Appropriations

	Appropriation	Expenditures	Balance
1928 Emergency Needs	$374 92	$374 92	–
1928 Renovation of Farmhouse	1,795 84	1,758 78	$37 06[1]
1928 Farm Cottage	342 94	–	342 94[1]
1928 Refrigeration Fisher Laboratory	945 65	633 38	312 27[1]
1928 Equipment Power Plant	11,004 00	29 77	10,974 23[1]
	–	–	79 58[1]
1929 Building for Horticultural Manufactures	69,966 92	15,211 14	54,755 78
1929 Emergency Needs	5,000 00	2,383 30	2,616 70
1929 Abattoir for Animal Husbandry	14,000 00	8,695 27	5,304 73
1929 Renovation Dairy Laboratory	4,000 00	–	4,000 00
1929 Garage Construction	2,500 00	2,372 87	127 13
1929 Roads Construction	10,000 00	9,962 49	37 51
1929 Poultry House and Hot Water Brooder	2,050 00	1,404 22	645 78
1929 Renovation Brooks Farm Barn	5,400 00	5,161 81	238 19
1929 Greenhouse M. G. F. Station	15,000 00	2,459 53	12,540 47
	$142,380 27	$50,447 48	$92,012 37
Less	–	–	11,746 08[1]
			$80,266 29

[1] Reverted to State Treasurer.

College Buildings (Estimated Value, 1929)

	Inventory at Beginning of Year	Per Cent deducted	Value at Beginning of Year less Deterioration	Repairs and Improvements during Year	Total Value at Close of Fiscal Year
Adams Hall	$117,164 27	2	$114,820 98	$1,071 85	$115,892 83
Agricultural Engineering Bldg.	13,958 40	2	13,679 23	66 25	13,745 48
Apiary	2,713 76	2	2,659 48	5 88	2,665 36
Cashier's House	2,503 73	5	2,378 54	70 39	2,448 93
Chemistry Store House	45 09	2	44 19	–	44 19
Clark Hall	59,429 22	2	58,240 64	938 84	59,179 48
Draper Hall	73,140 80	3	70,946 58	2,366 42	73,313 00
Drill Hall and Gun Shed	24,286 89	5	23,072 55	1,699 13	24,771 68
Durfee Glass House, old	13,919 07	5	13,223 12	116 77	13,339 89
Durfee Glass House, new	8,350 70	5	7,933 16	771 72	8,704 88
Farm Blacksmith Shop	359 06	3	348 29	–	348 29
Farm Bungalow No. 1	2,785 81	3	2,702 24	45 76	2,748 00
Farm Bungalow No. 2	4,000 38	3	3,880 37	77 07	3,957 44
Farm Bungalow No. 3	3,939 82	3	3,821 63	15 91	3,837 54
Farm Bungalow Garage	332 50	5	315 87	–	315 87
Farm Bull Pens and Fence	3,709 68	5	3,524 20	288 65	3,812 85
Farm Corn Cribs (7)	617 50	5	586 62	–	586 62
Farm Dairy Barns and Storage	27,780 35	3	26,946 94	435 70	27,382 64
Farm Horse Barn No. 1	4,736 45	3	4,594 36	49 72	4,644 08
Farm Horse Barn No. 2	5,293 51	5	5,028 83	294 75	5,323 58
Farm House	3,915 37	3	3,797 91	285 82	4,083 73
Farm Machinery Barn	3,323 54	3	3,223 83	25 10	3,248 93
Farm Piggery	2,427 69	3	2,354 86	61 23	2,416 09
Farm Sheep Barn	1,437 79	3	1,394 66	6 79	1,401 45
Farm Young Stock, including Isolation and Quarantine Barns	18,504 21	3	17,949 08	534 68	18,483 76
Fernald Hall	67,280 19	2	65,934 59	388 12	66,322 71
Fisher Laboratory	16,472 03	2	16,142 59	48 05	16,190 64
Flint Laboratory	68,404 11	2	67,036 03	630 01	67,666 04
French Hall	43,716 10	2	42,841 78	977 68	43,819 46
Garage (six)	–	–	–	–	2,372 87
Goessmann Laboratory	270,725 24	2	265,310 74	1,555 93	266,866 67
Grinnell Arena	8,473 62	2	8,304 15	8,848 19	17,152 34
Grounds Tool Shed	147 59	5	140 21	–	140 21
Harlow House	1,680 46	5	1,596 44	24 88	1,621 32
Head of Division of Hort., House	2,968 68	5	2,820 25	223 82	3,044 07
Home Practice House for Girls	8,127 34	5	7,720 97	199 45	7,920 42

College Buildings (Estimated Value, 1929) — *Concluded*

	Inventory at Beginning of Year	Per Cent deducted	Values at Beginning of Year less Deterioration	Repairs and Improvements during Year	Total Value at Close of Fiscal Year
Horticultural Barn	$3,735 40	3	$3,623 34	$320 93	$3,944 27
Horticultural Garage	1,330 96	3	1,291 03	214 55	1,505 58
Horticultural Tool Shed	4,659 10	3	4,519 33	–	4,519 33
Horticultural Open Shed	344 14	5	326 93	–	326 93
Horticultural Manufactures Shed	2,565 24	5	2,436 98	–	2,436 98
Hospital	15,672 13	2	15,358 69	950 44	16,309 13
Jewett House and Barn	2,760 67	5	2,622 64	306 20	2,928 84
Library	30,013 08	2	29,412 82	191 64	29,604 46
Market Garden Field Station: Greenhouses	13,176 69	2	12,913 16	–	12,913 16
Market Garden Field Station Office and Laboratory Building	7,529 54	2	7,378 95	–	7,378 95
Market Garden Field Station Farmhouse	5,007 93	5	4,757 53	24 50	4,782 03
Market Garden Field Station Ice House	81 45	5	77 38	–	77 38
Market Garden Field Station Large Cow Barn	7,330 55	5	6,964 02	–	6,964 02
Market Garden Field Station Small Stock Barn	1,629 01	5	1,547 56	–	1,547 56
Market Garden Field Station Small Shed	644 38	5	612 16	–	612 16
Mathematics Building	4,887 13	5	4,642 77	583 24	5,226 01
Memorial Hall	94,342 47	2	92,455 62	470 98	92,926 60
Microbiology Building	52,791 10	2	51,735 28	699 65	52,434 93
Military Storage	149 68	5	142 20	–	142 20
Mount Toby House and Barn	2,680 37	5	2,546 35	–	2,546 35
North Dormitory	29,861 17	2	29,263 95	602 24	29,866 19
Paige Laboratory and Stable	24,643 26	2	24,150 39	981 11	25,131 50
Physics Laboratory	8,621 71	5	8,190 62	190 10	8,380 72
Poultry Department:					
No. 1, Demonstration Building	2,223 49	2	2,179 02	134 24	2,313 26
No. 2, Oil House	142 15	2	139 31	30	139 61
No. 3, Brooder, killing and fattening laboratory	2,957 36	2	2,898 21	2 18	2,900 39
No. 4, Mechanics, storage building and incubator cellar	3,981 97	2	3,902 33	20 27	3,922 60
No. 5, Laying House	1,767 28	2	1,731 93	379 64	2,111 57
No. 6, Manure Shed	132 99	2	130 33	4 59	134 92
No. 7, Small Henhouse	52 10	2	51 06	–	51 06
No. 8, Breeding House	1,363 62	2	1,336 35	–	1,336 35
No. 9, Experimental Breeding House	619 18	2	606 80	–	606 80
No. 10, Duck House	110 09	2	107 89	–	107 89
No. 11, Unit House for 200 hens	443 16	2	434 30	–	434 30
No. 12, Unit house for 100 hens	412 81	2	404 55	–	404 55
No. 13, Hot Water Brooder	–	–	–	70	1,404 92
Power Plant and storage buildings, including coal pocket	46,809 32	2	45,873 13	665 82	46,538 95
President's House	14,603 34	3	14,165 24	1,780 69	15,945 93
South Dormitory	44,261 17	2	43,375 95	2,647 63	46,023 58
Stockbridge Hall	151,603 38	2	151,300 17	695 97	151,996 14
Agronomy Greenhouse and Storage	4,562 59	2	4,471 34	–	4,471 34
Stockbridge House	1,813 40	5	1,722 73	6 17	1,728 90
Stable for Cavalry Unit	13,208 58	2	12,944 41	337 12	13,281 53
Blacksmith shop	672 28	2	658 83	–	658 83
Storage Barn	2,804 98	2	2,748 88	–	2,748 88
Turbine House	16,170 15	2	15,846 75	219 08	16,065 83
Vegetable Plant House	4,674 13	5	4,440 42	22 73	4,463 15
Waiting Station	677 93	2	664 37	8 18	672 55
Wilder Hall	30,280 42	2	29,674 81	232 61	29,907 42
	$1,547,475 98	–	$1,514,094 72	$34,818 06	$1,552,689 87

Experiment Station Buildings (Estimated Value, 1929)

	Inventory at Beginning of Year	Per Cent deducted	Value at Beginning of Year less Deterioration	Repairs and Improvements during Year	Total Value at Close of Fiscal Year
Agricultural Laboratory	$14,078 80	2	$13,797 22	$68 45	$13,865 67
Agricultural Barn	5,909 52	3	5,732 23	–	5,732 23
Agricultural Farmhouse	7,500 00	5	7,496 25	95 14	7,591 39
Agricultural Glasshouse	905 91	5	860 61	–	860 61
Brooks House	2,921 62	5	2,775 54	132 95	2,908 49
Brooks Barn and Sheds	1,113 00	5	1,057 35	5,163 62	6,220 97
Brooks Tobacco Barn	2,446 32	5	2,324 00	–	2,324 00
Brooks Farm Garage	–	–	–	165 27	165 27
Cranberry Buildings:					
Laboratory	6,050 52	2	5,929 51	–	5,929 51
Garage	1,322 07	2	1,295 63	–	1,295 63
Shed Storage	243 00	10	218 70	–	218 70
Pump House	148 91	5	141 46	–	141 46
Oil House	36 10	5	34 29	–	34 29
Entomological Glasshouse	456 17	5	433 36	–	433 36
Plant and Animal Chemistry Lab.	26,546 23	2	26,015 31	166 18	26,181 49
Plant and Animal Chemistry Barns	6,521 95	3	6,326 29	158 54	6,484 83
Plant and Animal Chemistry Barns Annex	1,556 33	3	1,509 64	–	1,509 64
Six Poultry Houses	635 28	2	622 57	–	622 57
Tillson Cottage	1,051 50	5	998 92	462 97	1,461 89
Tillson Barn	850 02	5	807 52	–	807 52
Tillson Poultry Houses (4), Nos. 1, 2, 3, 4	2,826 27	2	2,769 74	7 75	2,777 49
Tillson Pullet Brooder No. 5	947 00	5	899 65	2 10	901 75
Tillson Hen Brooder No. 6	987 09	5	937 74	–	937 74
Tillson Summer Sheds (3), Nos. 7, 8, 9	373 82	5	355 13	–	355 13
Tillson Foreman's Quarters and incubator cellar No. 10	6,584 31	2	6,452 62	56 90	6,509 52
	$92,011 74	–	$89,791 28	$6,479 87	$96,271 15

College Equipment (Estimated Value)

Administrative Division:	
Dean's Office and Schedule Room	$1,967 25
President's Office	2,688 63
Treasurer's Office	4,225 10
Agricultural Division:	
Agricultural Engineering	10,368 53
Agronomy	10,495 85
Animal Husbandry	867 49
Dairy	5,492 30
Farm, including livestock	74,067 30
Farm Management	1,582 72
Freshman Agriculture	231 59
General Agricultural Department	3,179 21
Poultry	8,195 45
Home Economics	14,269 18
Dining Hall	25,546 35
Extension Service	20,565 50
General Science:	
Apiary	2,730 09
Bacteriology and Physiology	32,402 95
Botany	26,231 73
Chemistry	32,980 03
Entomology	6,536 81
Mathematics	2,399 10
Physics	12,401 61
Veterinary	14,663 24
Zoölogy and Geology	18,650 59
Graduate School	176 20

Horticultural Division:	
Floriculture	$38,557 65
Forestry	302 19
General Horticulture	17,395 19
Grounds	2,577 67
Horticultural Manufactures	8,187 20
Landscape Gardening	6,186 75
Market Garden Field Station	3,991 90
Mount Toby Reservation	695 79
Pomology	7,843 85
Vegetable Garden	3,644 96
Hospital	1,080 70
Language and Literature	885 95
Library	161,779 29
Memorial Hall	13,701 64
Operating and Maintenance:	
College Supplies	1,083 90
Janitor Supplies	1,592 71
Fire Apparatus	1,667 94
General Maintenance:	
Office	775 05
Carpentry and Masonry supplies	6,216 39
Carpentry and Masonry Tools	4,661 99
Electrical Supplies	5,456 63
Electrical Tools	443 45
Electrical Supplies for Commencement	378 68
Heating and Plumbing Supplies	12,207 20
Heating and Plumbing Tools	2,614 38
Painting Supplies	1,649 23
Painting Tools	202 66
Gas Main	800 00
Steam Main	12,981 19
Lighting Lines	13,100 22
Sewer Line	12,642 13
Water Main	15,091 68
Roads and Walks	44,885 81
Power Plant:	
General Equipment	81,662 95
Tools	239 80
Supplies	126 10
Fuel	10,927 37
Physical Education	1,698 38
Social Sciences:	
Agricultural Economics	1,951 87
Agricultural Education	1,808 28
Economics, History and Sociology	256 55
Short Courses	2,800 13
Women's Dormitory	9,547 20
Social Union and Trophy Room	564 75
Text Books	1,651 74
Military	1,921 16
Total	$853,353 05

Experiment Station Equipment (Estimated Value)

Agricultural Economics	$648 29
Agricultural Engineering	282 00
Agricultural Laboratory	9,599 32
Agronomy	374 76

Bacteriology and Physiology	$4,828 18
Botany	9,906 85
Cranberry Station	11,544 42
Director's Office	6,035 60
Entomological Laboratory and Apiary	25,416 67
Entomology at Market Garden Field Station	334 47
Feed and Fertilizer Law	12,506 31
Meteorological Observatory	654 00
P & A Chemistry	20,215 88
Pomology	5,293 45
Poultry	6,940 40
Poultry Disease Law	20,100 35
Treasurer's Office	569 40
Veterinary	762 33
Laboratory Service:	
Pathology	221 70
Seed Law	2,489 30
	$138,723 68

Inventory — Real Estate (Estimated Value)

Angus Land	$800 00
Allen Place	500 00
Baker Place	2,500 00
Bangs Place	2,350 00
Brooks Farm	11,000 00
Brown Land	500 00
Charmbury Place	450 00
Clark Place	4,500 00
College Farm	37,000 00
Cranberry Land	16,300 00
George Cutler, Jr., Trustee	2,700 00
Dickinson Land	7,850 00
Harlow Farm and Orchard	3,284 63
Hawley and Brown Place	675 00
Kellogg Place	3,368 45
Loomis Place	415 00
Louisa Baker Place	5,000 00
Market Garden Field Station	21,000 00
Mount Toby Demonstration Forest	30,000 00
Newell Farm	2,800 00
Old Creamery Place	1,000 00
Owen Farm	5,000 00
Pelham Quarry	500 00
Q. T. V. Land	12,000 00
Tillson Farm	2,950 00
Westcott Land	2,250 00
	$176,693 08

	Acres
College Estate (area)	705.59
Cranberry Station, Wareham (area)	28.36
Market Garden Field Station, Waltham (area)	55.39
Mount Toby demonstration forest (area)	755.27
Rifle Range	46.20
Pelham Quarry	.50
	1,591.31

Summary

Land	$176,693 08
College Buildings	1,552,689 87
College Equipment	853,353 05
Experiment Station Buildings	96,271 15
Experiment Station Equipment	138,723 68
Total	$2,817,730 83

Dining Hall Statement November 30, 1929

Balance December 1, 1928		$9,877 23
Total Disbursements	$115,113 78	
Outstanding bills, November 30, 1929	1,881 26	
Outstanding accounts:		
Board		267 85
Special Service		145 13
Inventory, November 30, 1929		7,163 72
Total Collections		119,340 02
Balance	19,798 91	
	$136,793 95	$136,793 95

Special Funds

Burnham Emergency Fund

	Market Value Dec. 1, 1929	Par Value	Income
One bond Indianapolis Water Works Securities 5s	$410 00	$500 00	$25 00
One bond Jersey Central Power and Light Co. 5½s	497 50	500 00	27 50
Two bonds Narragansett Co. 5s @ 99	1,980 00	2,000 00	100 00
Two bonds Power Corp. of New York 6½s @ 101	2,020 00	2,000 00	130 00
	$4,907 50	$5,000 00	$282 50
Unexpended balance Dec. 1, 1928	–	–	384 60
	–	–	$667 10
Disbursements for fiscal year ending Nov. 30, 1929	–	–	70 00
Cash on hand Nov. 30, 1929	–	–	$597 10

Library Fund

One bond Cities Service Power and Light 5½s	$870 00	$1,000 00	$55 00
Four bonds Illinois Power and Light Corp. 5s @ 93½	3,740 00	4,000 00	200 00
Five bonds New York Central and Hudson River R.R. 4s @ 93	4,650 00	5,000 00	200 00
Two shares New York Central stock @ 174	348 00	200 00	16 00
Amherst Savings Bank deposit	175 52	175 52	8 86
	$9,783 52	$10,375 52	$479 86
Unexpended balance Dec. 1, 1928	–	–	1 57
	–	–	$481 43
Disbursements for fiscal year ending Nov. 30, 1929	–	–	481 43
	–	–	–

Endowed Labor Fund (Gift of a Friend of the College)

Two bonds Cities Service Power and Light 5½s @ 87	$1,740 00	$2,000 00	$110 00
One bond Jersey Central Power and Light 5½s	995 00	1,000 00	55 00
Two bonds Narragansett Co. 5s @ 99	1,980 00	2,000 00	100 00
One bond New York Central and Hudson River 4s	930 00	1,000 00	40 00
One bond State and Washington Building 5s	860 00	1,000 00	50 00
Two bonds Texas-Louisiana Power Co. 6s @ 93	1,860 00	2,000 00	60 00
	$8,365 00	$9,000 00	$415 00
Unexpended balance Dec. 1, 1928	–	–	1,401 67
Amherst Savings Bank, Interest	–	–	32 74
Amherst Savings Bank (taken from accumulated earnings, $1,000.00)	–	–	1,143 39
	–	–	$2,992 80
Expenses in connection of buying bonds, Prin. $1,990, Int. $12.66	–	–	2,002 66
	–	–	$990 14
Disbursements for fiscal year ending Nov. 30, 1929	–	–	611 97
Cash on hand Nov. 30, 1929	–	–	$378 17

Whiting Street Scholarship Fund

	Market Value Dec. 1, 1929	Par Value	Income
One bond New York Central and Hudson River 4s	$930 00	$1,000 00	$40 00
One bond Texas-Louisiana Power Company 6s	930 00	1,000 00	30 00
	$1,860 00	$2,000 00	$70 00
Unexpended balance Dec. 1, 1928	–	–	275 40
Amherst Savings Bank, Interest	–	–	21 36
Amherst Savings Bank (taken from accumulated earnings)	–	–	771 64
	–	–	$1,138 40
Expenses in connection of buying bond, Prin. $995, Int. $6.34	–	–	1,001 34
Cash on hand November 30, 1929	–	–	$137 06

Hills Fund

Boston and Albany R.R. stock 3⅝ shares @ 173	$627 00	$362 00	$31 68
One bond Great Western Power 5½s	970 00	1,000 00	55 00
One bond Indianapolis Water Works Securities 5s	820 00	1,000 00	50 00
One bond Monongahela West Penn Pub service 5½s	980 00	1,000 00	55 00
One bond Narragansett Co. 5s	990 00	1,000 00	50 00
One bond New York Central 4s	900 00	1,000 00	40 00
One bond Oklahoma Gas & Electric Company 6s	1,000 00	1,000 00	60 00
Three bonds Pacific Telephone and Telegraph Co. 5s @ 101½	3,045 00	3,000 00	150 00
Prudence Bonds Corp. 1⅝₀ bonds 5½s @ 96	1,133 00	1,180 00	64 90
One bond State and Washington Bldg. 5s	860 00	1,000 00	50 00
One bond New York Central and Hudson River 4s	930 00	1,000 00	40 00
Two bonds Texas and Louisiana Power Co. 6s @ 93	1,860 00	2,000 00	60 00
Amherst Savings Bank	72 75	72 75	3 65
Prudence & Company 5½s @ 90	1,350 00	1,500 00	82 50
	$15,537 75	$16,114 75	$792 73
Unexpended balance Dec. 1, 1928	–	–	1,055 52
Amherst Savings Bank, Interest	–	–	72 91
Amherst Savings Bank (taken from accumulated earnings)	–	–	2,500 00
	–	–	$4,421 16
Expenses in connection of buying bonds, $3,467.50 Prin., $43.15 Int.	–	–	3,510 65
	–	–	$910 51
Disbursements for fiscal year ending Nov. 30, 1929	–	–	668 98
Cash on hand Nov. 30, 1929	–	–	$241 53

Mary Robinson Fund

Boston and Albany R.R. stock ⅜ share @ 173	$65 00	$38 00	$3 32
Prudence Bonds Corp. 4½₀ bond @ 96	787 00	820 00	45 10
Amherst Savings Bank deposit	142 00	142 00	7 18
	$994 00	$1,000 00	$55 60
Unexpended balance Dec. 1, 1928	–	–	226 30
Cash on hand November 30, 1929	–	–	$281 90

Grinnell Prize Fund

Ten shares New York Central stock @ 174	$1,740 00	$1,000 00	$80 00
Unexpended balance Dec. 1, 1928	–	–	456 87
	–	–	$536 87
Disbursements for prizes	–	–	50 00
Cash on hand November 30, 1929	–	–	$486 87

Gassett Scholarship

One bond New York Central and Hudson River 4s	$930 00	$1,000 00	$40 00
One bond Prudence & Co. 5½s	450 00	500 00	27 50
	$1,380 00	$1,500 00	$67 50
Unexpended balance Dec. 1, 1928	–	–	1 83
Amherst Savings Bank, Interest	–	–	14 86
Amherst Savings Bank ($500 taken from accumulated income)	–	–	511 64
	–	–	$595 83
Expended in connection with buying bonds, Prin. $492.50, Int. $10.16	–	–	502 66
Cash on hand November 30, 1929	–	–	$93 17

Massachusetts Agricultural College (Investment)

Three shares New York Central R.R. stock @ 174	$522 00	$300 00	$24 00
Unexpended balance Dec. 1, 1928	–	–	41 76
Cash on hand November 30, 1929	–	–	$65 76

Danforth Keyes Bangs Fund

	Market Value Dec. 1, 1929	Par Value	Income
Two bonds Narragansett Co. 5s @ 99	$1,980 00	$2,000 00	$100 00
Two bonds Pacific Telephone and Telegraph Co. 5s @ 101½	2,030 00	2,000 00	100 00
One bond State and Washington Building 5s	860 00	1,000 00	50 00
Two bonds Union Electric Light and Power Co. 5s @ 100	2,000 00	2,000 00	100 00
Interest from student loans	–	–	212 20
	$6,870 00	$7,000 00	$562 20
Unexpended balance Dec. 1, 1928	–	–	1,766 38
	–	–	$2,328 58
Total loans made to students during fiscal year, $7,273.25	–	–	–
Cash received on account of student loans, $7,147.75	–	–	–
Excess of loans made over accounts paid by students	–	–	125 50
Cash on hand November 30, 1929	–	–	$2,203 08

John C. Cutter Fund

One bond Pacific Telephone and Telegraph Co. 5s	$1,015 00	$1,000 00	$50 00
Unexpended balance Dec. 1, 1928	–	–	115 74
	–	–	$165 74
Disbursements for fiscal year ending Nov. 30, 1929	–	–	165 01
Cash on hand November 30, 1929	–	–	$0 73

Robert F. Pomeroy Library Fund

Two bonds Indiana Hydro-Electric Power Co. 5s @ 87	$1,305 00	$1,500 00	$75 00
Unexpended balance Dec. 1, 1928	–	–	38 12
	–	–	$113 12
Disbursements for fiscal year ending Nov. 30, 1929	–	–	50 59
Cash on hand November 30, 1929	–	–	$62 53

William R. Sessions Fund

Three bonds Indianapolis Water Works Securities 5s @ 82	$2,050 00	$2,500 00	$125 00
Five shares New York Central stock @ 174	870 00	500 00	40 00
One bond Power Corp. of New York 5½s	955 00	1,000 00	55 00
One bond Southern Illinois Light and Power Co. 6s	990 00	1,000 00	60 00
	$4,865 00	$5,000 00	$280 00
Unexpended balance Dec. 1, 1928	–	–	447 27
	–	–	$727 27
Disbursements for fiscal year ending Nov. 30, 1929	–	–	155 00
Cash on hand November 30, 1929	–	–	$572 27

Alvord Dairy Scholarship Fund

Two bonds Great Western Power Co. 5½s @ 97	$1,940 00	$2,000 00	$110 00
One bond Indianapolis Water Works Securities 5s	820 00	1,000 00	50 00
One bond Jersey Central Power and Light Co. 5½s	995 00	1,000 00	55 00
	$3,755 00	$4,000 00	$215 00
Unexpended balance Dec. 1, 1928	–	–	59 32
Amherst Savings Bank, Interest	–	–	24 20
Amherst Savings Bank (taken from accumulated earnings)	–	–	750 00
	–	–	$1,048 52
Disbursements for fiscal year ending Nov. 30, 1929.	–	–	360 00
Cash on hand November 30, 1929	–	–	$688 52

J. D. W. French Fund

Two bonds Great Western Power 5½s @ 97	$1,940 00	$2,000 00	$110 00
Two bonds Jersey Central Power and Light Co. 5½s @ 99½	1,990 00	2,000 00	110 00
Four bonds Oklahoma Gas and Electric Co. 6s @ 100	4,000 00	4,000 00	240 00
Two bonds Southern Illinois Light and Power Co. 6s @ 99	1,980 00	2,000 00	120 00
	$9,910 00	$10,000 00	$580 00
Unexpended balance Dec. 1, 1928	–	–	598 31
Amherst Savings Bank (interest)	–	–	16 90
Amherst Savings Bank (taken from accumulated earnings)	–	–	500 00
	–	–	$1,695 21
Disbursements for fiscal year ending Nov. 30, 1929	–	–	507 00
Cash on hand Nov. 30, 1929	–	–	$1,188 21

F. G. Crane Fund

	Market Value Dec. 1, 1929	Par Value	Income
Five bonds Illinois Power and Light Corp. 6s @ 101	$5,050 00	$5,000 00	$300 00
Five bonds Jersey Central Power and Light Co. 5½s @ 99½	4,975 00	5,000 00	275 00
Four bonds Monongahela West Penn Pub. Service 5½s @ 98	3,920 00	4,000 00	220 00
Four bonds Northern New York Utilities 6s @ 99	3,960 00	4,000 00	240 00
Two bonds Power Corp. of New York 6½s @ 101	2,020 00	2,000 00	130 00
Five bonds Florida Power Corp. 5½s @ 85½	4,275 00	5,000 00	137 50
Amherst Savings Bank	250 00	250 00	12 65
	$24,450 00	$25,250 00	$1,315 15
Unexpended balance Dec. 1, 1928	–	–	2,019 32
Tide Water Power Co.	–	–	137 50
Earnings from exchange of bonds	–	–	250 00
Difference between cost and par value of Florida bonds	–	–	300 00
	–	–	$4,021 97
Cancelled notes and cash scholarships	–	–	1,440 05
Charge in connection with purchasing bonds	–	–	68 75
Cash on hand November 30, 1929	–	–	$2,513 17

Charles A. Gleason Fund

Five bonds Prudence and Co. 5½s @ 90	$4,500 00	$5,000 00	$275 00
Interest from student loans	–	–	12 00
	–	–	$287 00
Unexpended balance Dec. 1, 1928	–	–	515 62
Cash on hand Nov. 30, 1929	–	–	$802 62

Porter L. Newton Fund

Eight bonds Brown Co. 5½s @ 93½	$7,480 00	$8,000 00	$440 00
Five bonds Illinois Power and Light Corp. 5½s @ 98½	4,925 00	5,000 00	275 00
Five bonds Puget Sound Power and Light 5½s @ 99½	4,975 00	5,000 00	275 00
Five bonds Virginia Electric and Power Co. 5s @ 98	4,900 00	5,000 00	250 00
Amherst Savings Bank deposit	411 33	411 33	20 81
	$22,691 33	$23,411 33	$1,260 81
Unexpended balance Dec. 1, 1928	–	–	1,369 01
	–	–	$2,629 82
Cash scholarships	–	–	1,500 00
Cash on hand November 30, 1929	–	–	$1,129 82

George H. Barber Fund

Five bonds Florida Power and Light Co. 5s @ 84½	$4,425 00	$5,000 00	$250 00
Unexpended balance Dec. 1, 1928	–	–	265 77
	–	–	$515 77
Disbursements for fiscal year ending Nov. 30, 1929	–	–	513 19
Cash on hand November 30, 1929	–	–	$2 58

Helen A. Whittier Memorial Fund

Cash on hand, uninvested	–	$3,000 00	–

Trust Account

Massachusetts Agricultural College Club — Student Loan Fund

Total amount of gift	$500 00	$500 00	–
Total loans	–	180 00	–
Amount available for loans	–	$320 00	–
Unexpended balance Dec. 1, 1928	–	–	$71 86
Interest from loans	–	–	8 90
	–	–	$80 76

4-H Club for Boys

Total amount of gift	$1,000 00	$1,000 00	–
Total loans	–	185 00	–
Amount available for loans	–	$815 00	–
Interest from loans	–	–	$18 67

4-H Club for Girls

	Market Value Dec. 1, 1929	Par Value	Income
Total amount of gift	$100 00	$100 00	–
Total Loans	–	100 00	–
	–	–	–

Summary

M. A. C. Club Student Loan Fund	–	$400 76	–
4-H Club for Boys	–	833 67	–
4-H Club for Girls	–	–	–
	–	$1,234 43	–

Summary of Balance on Hand of the Income from Funds Held in Trust by the M. A. C.

Burnham Emergency Fund	$597 10
Library Fund	–
Endowed Labor Fund	378 17
Whiting Street Scholarship Fund	137 06
Hills Fund	241 53
Mary Robinson Fund	281 90
Grinnell Prize Fund	486 87
Gassett Scholarship Fund	93 17
Massachusetts Agricultural College Investment Fund	65 76
Danforth Keyes Bangs Fund	2,203 08
John C. Cutter Fund	73
Robert F. Pomeroy Library Fund	62 53
William R. Sessions Fund	572 27
Alvord Dairy Scholarship Fund	688 52
J. D. W. French Fund	1,188 21
F. G. Crane Fund	2,513 17
Charles A. Gleason Fund	802 62
Porter L. Newton Fund	1,129 82
George H. Barber Fund	2 58
	$11,445 09
M. A. C. Club	400 76
4-H Club for Boys	833 67
	$12,679 52

I hereby certify that I have this day examined the Massachusetts Agricultural College Account, as reported by the Treasurer, Fred C. Kenney, for the year ending November 30, 1929. All bonds and investments are as represented in the Treasurer's report. All disbursements are properly vouched for, and all cash balances are found to be correct.

Frank Gerrett,
Auditor.

History of Special Funds

Burnham Emergency Fund. — A bequest of $5,000 from T. O. H. P. Burnham of Boston made without any conditions. The Trustees of the College have used this fund in any cases of emergency where funds were not available. At present the fund is intact and the income only has been used for such emergency matters as the Trustees have authorized. The fund now shows an investment of $5,000.

Library Fund. — The library of the College at the present time contains 84,526 volumes. The income from this fund raised by the alumni and others is devoted to its increase, and additions are made from time to time as the needs of the different departments require. Dec. 27, 1883, William Knowlton gave $2,000; Jan. 1, 1894, Charles L. Flint gave $1,000; and in 1887 Elizur Smith of Lee, Mass., gave $1,315. These were the largest bequests and the total now amounts to $10,375.52.

Endowed Labor Fund. — Gift of a friend of the College in 1901, income of which is to be used for the assistance of needy and deserving students, $5,000.

Whiting Street Scholarship Fund. — Gift of Whiting Street of Northampton. This fund is used exclusively for scholarships, $1,000.

Hills Fund. — Gift of Leonard M. and Henry F. Hills of Amherst, Mass., in 1867, to establish and maintain a botanic garden, $10,000.

Mary Robinson Fund. — Gift of Miss Mary Robinson of Medfield, in 1874, for scholarships, $1,000.

Grinnell Prize Fund. — Gift of Hon. Wm. Claflin, to be known as the Grinnell Agricultural Prize, to be given to the two members of the graduating class who may pass the best oral and written examination in theory and practice of agriculture, given in honor of George B. Grinnell of New York, $1,000.

Gassett Scholarship. — Gift of Henry Gassett of Boston, the income to be used for scholarships, $1,000.

Massachusetts Agricultural College Investment Fund. — Investment made by vote of Trustees in 1893 to purchase one share of New York Central and Hudson River Railroad stock. The income from this fund has been allowed to accumulate, $100.

Danforth Keyes Bangs Fund. — Gift of Louisa A. Baker of Amherst, Mass., April 14, 1909, the income thereof to be used annually in aiding poor, industrious, and deserving students to obtain an education in said college, $6,000.

John C. Cutter Fund. — Gift of Dr. John C. Cutter of Worcester, Mass., an alumnus of the College who died in August, 1909; to be invested by the trustees and the income to be annually used for the purchase of books on hygiene, $1,000.

Alvord Dairy Scholarship Fund. — Gift of Henry E. Alvord, who was the first instructor in military tactics, 1869–71, and professor of agriculture, 1885–87, at this Institution. The income of this fund is to be applied to the support of any worthy student of said College, graduate or postgraduate, who may be making a specialty of the study of the dairy husbandry (broadly considered), with the intention of becoming an investigator, teacher, or special practitioner in connection with the dairy industry, provided that no benefits arising from such fund shall at any time be applied to any person who then uses tobacco in any form, or fermented or spirituous beverages, or is known to have done so within one year next preceding, $4,000.

William R. Sessions Fund. — In accordance with the request of my deceased wife, Clara Markham Sessions, made in her last will, I bequeath to the trustees of the Massachusetts Agricultural College, Amherst, Mass., the sum of $5,000, it being the amount received by me from the estate of the said Clara Markham Sessions. The said $5,000 to be kept by the said trustees a perpetual fund, the income from which shall be for the use of the Massachusetts Agricultural College; and according to the further request of my deceased wife, made in her last will, this is to be known as the William R. Sessions fund, and is to be a memorial of William R. Sessions; and it is my special request that the said trustees shall make record of the fact that this fund came from the estate of my deceased wife, Clara Markham Sessions, in accordance with her request made in her last will, $5,000.

J. D. W. French Fund. — Gift of the Bay State Agricultural Society of Boston, Mass. This fund to be known as the J. D. W. French fund, and the trustees of the Massachusetts Agricultural College are to use the income of this fund where it will do the greatest good, in the interest of Dairying and its allies, also in Forestry, as scholarships, loans, or prizes; especially, however, to help pay the expenses of the judging teams to the National Dairy Shows and to the National Livestock Shows, $10,000.

Frederick G. Crane Fund. — Gift of Frederick G. Crane of Dalton, Mass. The income of this fund is to be expended by the Trustees of the Massachusetts Agricultural College in aid of worthy undergraduates of limited financial resources at the College, preference being given to residents of Berkshire County; such payments are to be known as the Frederick G. Crane Scholarships, $25,000.

Massachusetts Agricultural College Fund. — The Massachusetts Agricultural Club gave $500, to be used as a scholarship loan fund, to the Massachusetts

Agricultural College to help out deserving students there, who intended seriously to go into agriculture; interest on loans not to be charged until after graduation, $500.

Charles A. Gleason Fund. — The gift of Charles A. Gleason of North Brookfield, Mass., a trustee of the College from 1889 to his death, September 29, 1925. "A clean record of noble deeds." This fund is to be used as the trustees of the College shall direct, $5,000.

Porter L. Newton Educational Fund. — This is for the purpose of establishing a fund to be known as the Porter L. Newton Educational Fund, the income of which is to be used by the administrative officers of the Massachusetts Agricultural College, by means of Scholarships for the education of such citizens of the United States as said trustees may deem worthy and deserving of the same, such education to be along agricultural lines, it being my intention by this gift to do something which may tend to improve the general agricultural situation in Massachusetts.

Mr. Newton's original intention was that as far as possible, this money should be used to help young men obtain this sort of an education, particularly those young men who reside in Middlesex County. $23,411.33.

4-H Club Loan Fund for Boys. — Given by the Massachusetts Society for the Promotion of Agriculture to be used as a loan fund to help worthy boys, especially those formerly members of 4-H clubs, to obtain a general education at the Massachusetts Agricultural College. Such loans are to be made according to the general business practice, with interest, and all notes to mature within two years after graduation. $1,000.

4-H Club Loan Fund for Girls. — It is the wish of the administrative officers of the Massachusetts 4-H Club for Girls that this fund be increased largely by future donations. The first contribution is from Mrs. J. J. Storrow of Boston, Mass., $100. This is to be used as a loan fund for girls desiring a general education at the Massachusetts Agricultural College and is to be loaned on the same basis as the 4-H Club Loan Fund for Boys. $100.

George H. Barber Fund. — I give to the trustees of the Massachusetts Agricultural College at Amherst, Mass., $5,000, the same to be safely invested and the income to be used annually for the encouragement of general athletics, among the student body as a whole, in such manner as shall be designated by the President of the College. $5,000.

Robert F. Pomeroy Library Fund. — This is a gift of $1,500 from Ellen Pomeroy Moore established in memory of her brother, Robert F. Pomeroy of the Class of 1894. The income is to be used for the purpose of promoting and replenishing the Horticultural and Landscape Gardening section of the College Library. $1,500.

Helen A. Whittier Memorial Fund. — Given by the Massachusetts State Federation of Women's Clubs for the purpose of establishing scholarships in "Art as Applied to Living," income only to be used. $3,000.

Total of special funds, $124,986.85.

Fred C. Kenney,
Treasurer.

STATISTICS

Table I. — New Appointments

A. In the Academic Departments

Instructor in Chemistry: Martin E. Cupery, A.B., Hope College, 1924; M.S., Massachusetts Agricultural College, 1926.

Junior Clerk, Farm Management: Eleanor G. Dwyer.

Assistant Professor of Landscape Gardening: Clifford O. Gates, B.S.A., Purdue University, 1925.

Junior Clerk, President's Office: Julia E. Grybko.

Junior Clerk, Treasurer's Office: Pauline Hillberg.

Instructor in Landscape Architecture: Thure M. Leivo, B.Arch., Carnegie Institute of Technology, 1929.

Professor of Agricultural Economics: Adrian H. Lindsey, B.S., University of Illinois, 1922; M.S., Iowa State College, 1923; Ph.D., 1929.
Instructor in English: Faith E. Packard, B.S., Massachusetts Agricultural College, 1929.
Laboratory Assistant in Chemistry: Ernest M. Parrott, B.S., Union University, 1927.
Junior Clerk, Power Plant: Mrs. Elsie B. Sibenman.
Assistant Professor of Agricultural Engineering: William H. Tague, B.S., Iowa State College, 1924.
Junior Clerk, President's Office: Gladys C. Woodbury.

B. In the Experiment Station

Assistant Research Professor of Veterinary Science: Charles S. Gibbs, B.S., Bates College, 1916; M.S., Yale University, 1920; Ph.D., 1921.
Laboratory Assistant in Pomology: Mary C. Hughes.
Laboratory Assistant in Agricultural Economics: Katherine E. Shilling, A.B., Wellesley, 1928.

C. In the Control Service

Assistant Research Professor: Kenneth L. Bullis, D.V.M., Iowa State College, 1928.
Chief of Laboratory: Henry Van Roekel, D.V.M., Iowa State College, 1925; M.S., Virginia Polytechnic Institute, 1926.
Junior Chemist: John B. Zielinski, Jr., B.S., Massachusetts Agricultural College, 1929.

D. In the Extension Service

Junior Clerk: Irene L. Bouchard.
Junior Clerk, Department of Agronomy: Esther M. Larned.
Assistant Extension Specialist in Child Development: Mrs. Ruth D. Morley, B.S., Michigan State College, 1924.
Junior Clerk, Agricultural Economics: Mrs. Hazel D. Palmer.

E. In the Short Courses

Instructor in Vegetable Gardening: Kay H. Beach, B.S.A., Kansas State Agricultural College, 1928.
Instructor in Agricultural Economics: Ellsworth W. Bell, B.S., Pennsylvania State College, 1926; M.S., University of Vermont, 1928.
Junior Clerk: Catherine Heffernan.
Instructor in Horticulture: Wayne J. Lowry, B.S., Michigan State College, 1928.
Junior Clerk: Josephine A. Toole.

TABLE II. — SPEAKERS FOR THE YEAR

A. Assembly

1928		
Dec.	6.	Dr. Tehyi Hsieh, Director Chinese Trade Bureau, Boston, Mass.
Dec.	13.	Motion Pictures — Control of Forest Pests.
1929		
Jan.	2.	President Roscoe W. Thatcher, M. A. C.
Jan.	9.	Rev. M. J. Ahern, S.J., Weston College, Weston, Mass.
Jan.	16.	Dr. Raphael Zon, Director Lake States Forest Experiment Station.
Jan.	23.	Miss Lillian L. Picken, Social Worker from India.
Jan.	30.	Professor L. H. Packard, Amherst College.
Feb.	6.	Professor C. S. Hicks, M. A. C.
Feb.	13.	Dean W. L. Machmer, M. A. C.
Feb.	20.	Professor Warren K. Green, Amherst College.
Mar.	6.	Mr. Whiting Williams, Cleveland, Ohio.
Apr.	3.	President Roscoe W. Thatcher, M. A. C.
Apr.	10.	Dr. Louis C. Cornish, President, American Unitarian Association.
Apr.	17.	William I. Mayo, Director, New England Kurn Hattin Homes, Westminster, Vermont.

1929

Apr. 24. Walter Prichard Eaton, Sheffield, Mass.
May 8. Norman Thomas, Socialist Candidate for President, 1928.
May 15. Mrs. Anna Garlin Spencer, Columbia University.
May 22. Professor Ada L. F. Snell, Mount Holyoke College.
June 5. Professor Laurence R. Grose, M. A. C.
Sept. 18. President Roscoe W. Thatcher, M. A. C.
Sept. 26. Professor John Calder, Y. M. C. A. College, Springfield, Mass.
Oct. 3. Robert O. Small, Director of Vocational Education for Massachusetts.
Oct. 10. Professor S. Ralph Harlow, Smith College.
Oct. 17. Professor Dean Peabody, Jr., Massachusetts Institute of Technology.
Oct. 31. Professor Frank Prentice Rand, M. A. C.
Nov. 7. President Arthur Stanley Pease, Amherst College.
Nov. 14. Dr. Bhaskar P. Hivale of India.
Nov. 21. Mr. Waldo L. Cook, Editor, Springfield Republican.

1928

B. Sunday Chapel

Dec. 9. Dr. H. Adye Prichard, Mount Kisco, N. Y.
Dec. 16. Dr. Robert E. Speer, Moderator, The Presbyterian Church in the U. S. A.

1929

Jan. 7. Rev. Arthur Lee Kinsolving, Amherst, Mass.
Jan. 13. Professor H. M. J. Klein, Franklin and Marshall College.
Jan. 20. Dr. Nehemiah Boynton, Newton Center, Mass.
Jan. 27. Rev. John Alison, Holyoke, Mass.
Feb. 3. President Donald J. Cowling, Carleton College.
Feb. 10. President J. Edgar Park, Wheaton College.
Feb. 17. Rev. J. Burford Parry, Springfield, Mass.
Mar. 3. Principal Alfred E. Stearns, Phillips Academy, Andover, Mass.
Mar. 10. President Paul D. Moody, Middlebury College.
Mar. 17. Dean Shailer Mathews, University of Chicago.
Apr. 7. Professor Henry H. Tweedy, Yale University.
Apr. 14. Professor Hugh Black, Union Theological Seminary.
Nov. 3. Dr. James Gordon Gilkey, Springfield, Mass.
Nov. 10. Rev. K. C. MacArthur, Town and Country Secretary of Mass. Federation of Churches, Sterling, Mass.
Nov. 17. Rev. J. Burford Parry, Springfield, Mass.
Nov. 24. Dr. Robert E. Speer, Moderator, The Presbyterian Church in the U. S. A.

TABLE III. — ATTENDANCE

	Registration Nov. 1, 1928			Registration Nov. 1, 1929		
	Men	Women	Total	Men	Women	Total
A. In the Work of College Grade						
Graduate Students	38	8	46	41	7	48
Senior Class	82	23	105	87	28	115
Junior Class	100	27	127	87	28	115
Sophomore Class	114	34	148	123	37	160
Freshman Class	170	48	218	155	45	200
Special Students	1	2	3	2	–	2
Totals	505	142	647	495	145	640
B. Stockbridge School						
Second year	102	4	106	98	10	108
First year	126	10	136	109	5	114
Totals	228	14	242	207	15	222
C. Short Course Enrollment						
Winter School	67	8	75	47	6	53
Summer School	51	114	165	53	111	164
Vocational Poultry Course	3	1	4	–	–	–
Totals	121	123	244	100	117	217

D. Educational Meetings

	1928	1929
Annual Extension Service Conference	125	125
Boston Gardeners' and Florists' Club	40	–
Boston Market Gardeners' Association at Field Station	–	150
Camp Gilbert (4-H Club members and leaders)	160	160
Canadian Tobacco Growers	–	50
College Stock Judging Teams	–	20
Connecticut Poultry Breeders	–	30
Connecticut Valley Day	225	300
Connecticut Valley Section, American Chemical Society	75	–
Connecticut Valley Student Volunteer Association	36	20
Dad's Day	–	140
Eastern Farm Bureau Training School	–	125
Eastern States Farmers Exchange	–	35
English Folk Dance School	140	140
Extension Home Economics Conference	25	25
Extract Manufacturers' Ice Cream Conference	21	–
Fall Horticultural Exhibition	2,000	2,000
Farm and Home Week	3,500	3,500
Field Day, Market Garden Field Station	650	900
4-H Canning and Garden Leaders	42	60
4-H Club Agents' Conference	22	30
4-H Leaders' Canning School	15	–
Hampden County Commercial Canners' Association	–	10
Hampden County Women's Club	–	250
Hampden, Franklin Holstein-Freisian Club	–	75
Hampshire County Poultry Association	–	20
High School Day	1,000	940
Holstein Breeders' Association	–	50
International Students' Educational Group	35	–
Laboratory Workers in Pullorum Disease Control	12	–
Lawn Day	50	–
Massachusetts Elementary Principals' Association	–	300
Massachusetts Home Economics Association	200	–
Massachusetts Veterinarian Association	35	33
Middlesex County 4-H Club Champions	80	80
Mt. Holyoke College Student Group	–	15
New England Ayrshire Breeders' Association	–	30
New England Grange Lecturers' Conference	–	1,000
New England Institute of Cooperation	150	–
New England Livestock Sanitary Officials	20	–
Northampton Florists' and Garden Club	25	25
Northeastern States Extension Agronomists	25	–
Poultry Breeders' Conference	125	150
Springfield Garden Club	50	–
Spring Flower and Greenkeepers' Exhibition	1,000	1,000
State 4-H Dairy Club	–	60
Students' League of Nations Assembly	–	120
Three County Fruit Meeting	90	125
Tobacco Field Day	70	60
Tobacco Research Workers	30	–
Women's Advisory Council	–	40
Vocational Agricultural Teachers at Field Station	–	30
Women's 4-H Club Agents' Conference	–	10
Totals	10,073	12,273

Table IV. — Statistics of Freshmen Entering in September, 1929

A. *Home Addresses of Students (classified by Towns and Cities)*

Abington	1	Glastonbury, Conn.	1	Northampton	2
Adams	2	Glen Rock, N. J.	1	North Andover	1
Agawam	1	Gloucester	2	North Brookfield	1
Amesbury	1	Granby	1	Northfield	1
Amherst	10	Great Neck, N. Y.	1	Norton	1
Andover	1	Greenfield	3	Norwalk, Conn.	1
Ashburnham	1	Groton	1	Palmer	1
Attleboro	1	Hadley	2	Peabody	1
Auburn	1	Halifax	1	Pittsfield	1
Barre	1	Hanover	1	Plainfield	1
Bedford	1	Harvard	1	Provincetown	1
Boston	18	Haverhill	1	Quincy	2
Braintree	3	Hawley	1	Reading	1
Bridgeport, Conn.	1	Hempstead, N. Y.	1	Richmond	1
Brookfield	1	Holden	1	Sandwich	1
Brookline	2	Holyoke	10	Seekonk	1
Brookline, Pa.	1	Hudson	1	Sharon	2
Buckland	1	Lee	1	Short Beach, Conn.	1
Cambridge	1	Leicester	1	Somerville	1
Charlton	1	Littleton	1	South Hadley	1
Chatham	1	London, Eng.	1	Springfield	4
Chelsea	1	London, Ontario, Can.	1	Springfield, Vt.	1
Cheshire	1	Lowell	2	Stoughton	1
Chester	1	Lynn	5	Sunderland	1
Chicopee	1	Malden	1	Townsend	2
Churchville, Pa.	1	Maple Falls, Wash.	1	Troy Hills, N. J.	1
Clinton	1	Marblehead	2	Wakefield	1
Colrain	1	Maynard	1	Waltham	1
Colombia, S. A.	1	Medford	1	Ware	7
Concord	1	Melrose	1	Wayland	2
Cummington	2	Mendon	1	Wellesley	1
Dalton	1	Monson	1	Westborough	2
Danvers	1	Montague	3	West Bridgewater	1
Dedham	1	Narragansett, R. I.	1	Westfield	4
Deerfield	1	Needham	1	Westport	1
Dracut	1	New Bedford	1	Williamsburg	1
Everett	2	Newton	1	Windsor, Conn.	1
Fall River	1	New York, N. Y.	2	Winthrop	1
Framingham	1	Norfolk	1	Worcester	8
Franklin	1	North Adams	2	Wrentham	1

B. *Home Addresses (classified by States and Countries)*

	Number	Per Cent		Number	Per Cent
Canada	1	.5	Pennsylvania	2	1.0
Connecticut	5	2.5	Rhode Island	1	.5
England	1	.5	South America	1	.5
Massachusetts	181	90.5	Vermont	1	.5
New Jersey	2	1.	Washington	1	.5
New York	4	2.			
				200	100.0

C. *Home Addresses (classified by Counties of Massachusetts)*

	Number	Per Cent		Number	Per Cent
Barnstable	3	1.66	Hampshire	27	14.92
Berkshire	9	4.97	Middlesex	25	13.81
Bristol	6	3.31	Norfolk	16	8.84
Essex	15	8.29	Plymouth	4	2.21
Franklin	12	6.63	Suffolk	20	11.05
Hampden	23	12.71	Worcester	21	11.60
				181	100.00

D. *Nativity of Parents*

	Number	Per Cent
Neither parent foreign born	132	66.00
Both parents foreign born	47	23.50
Father (only) foreign born	13	6.50
Mother (only) foreign born	8	4.00
	200	100.00

E. Education of Father

	Number	Per Cent
Common School	73	36.50
High School	73	36.50
Business School	21	10.50
College or University	25	12.50
No statistics	8	4.00
	200	100.00

F. Occupation of Father

	Number	Per Cent
Agriculture and Horticulture	35	17.50
Artisans	40	20.00
Business	75	37.50
Professional	20	10.00
Miscellaneous	15	7.50
Retired	3	1.50
Deceased	10	5.00
No statistics	2	1.00
	200	100.00

G. Intended Vocation of Students

	Men	Women	Total	Per Cent
1. *Farming*, including Market Gardening, Nursery business, Florist's business, Fruit Growing, Management of Estates, General Farming, Poultry Husbandry, Livestock Breeding, etc.	13	2	15	7.50
2. *Agricultural Business*, including sales of agricultural products and other capacities in such as the fertilizer industry, the feed industry, etc.	1	–	1	.50
3. *Science*, including Chemistry, Botany, Entomology, Bacteriology, etc., in such capacities as research experts, laboratory assistants, technologists, etc.	36	10	46	23.00
4. Landscape Architects and Agricultural Engineers	19	1	20	10.00
5. *Teachers*, including College Professors, High School Instructors, Specialists in Extension Education, etc.	9	8	17	8.50
6. *Professional Practitioners*, including Physicians, Surgeons, Dentists, Lawyers, Veterinarians, Ministers, etc.	16	1	17	8.50
7. Civil Engineers	–	–	–	–
8. *Industrial Enterprises*, including Manufacturing, Merchandising, Advertising, Banking, Accounting, Real Estate, Insurance, etc.	1	1	2	1.00
9. Authors, Artists, Journalists, etc.	1	–	1	.50
10. Home Economics	–	7	7	3.50
11. Miscellaneous	4	2	6	3.00
12. Undecided	55	13	68	34.00
	155	45	200	100.00

H. Farm Experience

	Men	Women	Total	Per Cent
Brought up on a farm	31	9	40	20.00
Not brought up on a farm and having no or practically no farm experience	90	30	120	60.00
Not brought up on a farm but having had some farm experience	34	6	40	20.00
	155	45	200	100.00

I. Miscellaneous Statistics

Average age (years)	18.79

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THE M. A. C. BULLETIN
AMHERST, MASSACHUSETTS

VOLUME XXII JANUARY, 1930 NUMBER 1

PUBLISHED EIGHT TIMES A YEAR BY THE MASSACHUSETTS AGRICULTURAL COLLEGE: JAN., FEB., MAR., MAY, JUNE, SEPT., OCT., NOV. ENTERED AT THE POST OFFICE, AMHERST, MASS., AS SECOND CLASS MATTER.

THE SIXTY-SEVENTH ANNUAL REPORT OF THE MASSACHUSETTS AGRICULTURAL COLLEGE

PART II. — CATALOGUE OF THE COLLEGE FOR 1929 — 1930

PUBLICATION OF THIS DOCUMENT APPROVED BY THE COMMISSION ON ADMINISTRATION AND FINANCE

6M-9-'29. No. 6784

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Legislation Pertaining to the College.

Without excluding other scientific and classical studies, and including military tactics, to teach such branches of learning as are related to agriculture and mechanic arts in such manner as the legislatures of the states may respectively prescribe, in order to promote the liberal and practical education of the industrial classes in the several pursuits and professions of life. — *Act of Congress, July 2, 1862.*

The College Charter. — "The leading object of the college shall be to teach subjects relating to agriculture and the mechanic arts, so as to promote liberal and practical education. Its curriculum may include other scientific and classical studies and shall include military tactics." — *From Chapter 75 of the General Laws of Massachusetts.*

This issue of the catalogue represents the status of the college for the current college year, with provisional announcement of courses of study and other matters for the year to follow. When deemed necessary, additional announcements are made in a supplementary bulletin, published in the spring.

The college reserves, for itself and its departments, the right to withdraw or change the announcements made in its catalogue.

CALENDAR.

1929-1930.

September 11–14, Wednesday–Saturday	Entrance Examinations
September 16, Monday	Fall term begins for Freshmen
September 18, Wednesday	Fall term begins for all except Freshmen
October 12, Saturday	Holiday, Columbus Day
November 11, Monday	Holiday, Armistice Day
November 27–December 2, Wednesday, 12 M.–Monday, 7.30 A.M.	Thanksgiving Recess
December 21, Saturday, 12 M.	Fall term ends

1930.

January 2, Thursday, 8.00 A.M.	Winter term begins
February 22, Saturday	Holiday, Washington's Birthday
March 22, Saturday, 12 M.	Winter term ends
March 31, Monday, 7.30 A.M.	Spring term begins
April 19, Saturday	Holiday, Patriots' Day
May 30, Friday	Holiday, Memorial Day
June 13–16, Friday–Monday	Commencement
June 19–21, Thursday–Saturday	Entrance Examinations
September 17–20, Wednesday–Saturday	Entrance Examinations
September 22, Monday	Fall term begins for Freshmen
September 24, Wednesday	Fall term begins for all except Freshmen
October 13, Monday	Holiday, Observance of Columbus Day
November 11, Tuesday	Holiday, Armistice Day
November 26–December 1, Wednesday, 12 M.–Monday, 7.30 A.M.	Thanksgiving Recess
December 20, Saturday, 6 P.M.	Fall term ends

1931.

January 5, Monday, 7.30 A.M.	Winter term begins

THE TRUSTEES.

Organization of 1929.

Members of the Board.

	Term expires
Sarah Louise Arnold of Lincoln	1930
James F. Bacon of Boston	1930
Frank Gerrett of Greenfield	1931
Harold L. Frost of Arlington	1931
Charles H. Preston of Danvers	1932
Carlton D. Richardson of West Brookfield	1932
Davis R. Dewey of Cambridge	1933
John F. Gannon of Pittsfield	1933
George H. Ellis of West Newton	1934
Philip F. Whitmore of Sunderland	1934
John Chandler of Sterling Junction	1935
Frederick D. Griggs of Springfield	1935
Nathaniel I. Bowditch of Framingham	1936
Howard S. Russell of Waltham	1936

Members Ex Officio.

His Excellency Governor Frank G. Allen of Boston, *President of the Board of Trustees.*
Roscoe W. Thatcher, *President of the College.*
Payson Smith, *State Commissioner of Education.*
Arthur W. Gilbert, *State Commissioner of Agriculture.*

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His Excellency Governor Frank G. Allen of Boston, *President.*
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Robert D. Hawley of Amherst, *Secretary.*
Fred C. Kenney of Amherst, *Treasurer.*
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Nathaniel I. Bowditch.
Frederick D. Griggs.
Carlton D. Richardson.
Harold L. Frost.

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Payson Smith.
John Chandler.
John F. Gannon.
Arthur W. Gilbert.
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[1] The President of the College is ex-officio member of each committee.

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Nathaniel I. Bowditch, *Chairman.*
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George H. Ellis.
Arthur W. Gilbert.
Carlton D. Richardson.

Committee on Horticulture.

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John Chandler.
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Charles H. Preston.

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Miss Sarah Louise Arnold.

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As of November 1, 1929.

Officers of Administration.

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Dean.
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Treasurer.
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Director of the Experiment Station.
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Director of Short Courses.
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Mrs. LUCIA G. CHURCH North Amherst.
Secretary to the Director.
F. ETHEL FELTON, B.A. The Davenport.
Editorial Assistant.

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LORIAN P. JEFFERSON, M.A. 62 Pleasant Street.
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JOHN G. ARCHIBALD, M.S. North Amherst.
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JOHN S. BAILEY, M.S. 29 Main Street.
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VICTOR A. TIEDJENS, M.S. Waltham.
Assistant Research Professor of Vegetable Gardening.
EMIL F. GUBA, Ph.D. Waltham.
Assistant Research Professor of Botany.
WARREN D. WHITCOMB, B.S. Waltham.
Assistant Research Professor of Entomology.
JAMES E. FULLER, Ph.D. North Amherst.
Assistant Research Professor of Bacteriology.
LINUS H. JONES, Ph.D. 1 Allen Street.
Assistant Research Professor of Botany.
ESTHER S. DAVIES, Ph.B. Lincoln Block.
Assistant Research Professor of Home Economics.
RONALD L. MIGHELL, M.S. Oneacre.
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KENNETH E. WRIGHT, M.S. 116 North Pleasant Street.
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CHARLES S. GIBBS, D.V.M., Ph.D. . . .
Assistant Research Professor of Veterinary Science.

EXPERIMENT STATION ASSISTANTS.

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JAMES R. ALCOCK North Amherst.
Technical Assistant in Animal Nutrition.
ALYN S. BALL 94 Main Street.
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JOSEPH L. KELLEY East Wareham.
Technical Assistant in Cranberry Studies.
JOHN W. LOCKE Tillson Farm.
Poultry Plant Foreman.
GLADYS I. MINER 87 Pleasant Street.
Herbarium Curator.
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MOSES E. SNELL Brooks Farm.
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Laboratory and Control Service Staff.

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PHILIP H. SMITH, M.S. 102 Main Street.
Chief of Laboratory Feed Control.
HENRY VANROEKEL, M.S., D.V.M. Lincoln Block.
Chief of Laboratory Poultry Disease Control.
H. ROBERT DEROSE, M.S. Farview Way.
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KENNETH L. BULLIS, D.V.M.
Assistant Veterinary Pathologist.
GLEN L. DUNLAP, D.V.M. 53 Lincoln Avenue.
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Inspector.
JOHN W. KUZMESKI, B.S. Leverett.
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Extension Service Staff.

ADMINISTRATIVE OFFICERS.

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President.
WILLARD A. MUNSON, B.S. 101 Butterfield Terrace.
Director.
SUMNER R. PARKER, B.S. South Amherst.
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State Leader of County Club Agents.
Mrs. ANNETTE T. HERR, A.M. 62 Pleasant Street.
State Leader of County Home Demonstration Agents.
HARLEY A. LELAND, B.S. Agr. 70 Lincoln Avenue.
Assistant State Leader of County Club Agents.
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GRUNOW O. OLESON, M.S. North Amherst.
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WILLIAM R. COLE 33 Fearing Street.
Extension Specialist in Horticultural Manufactures.

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Extension Specialist in Farm Management.

RAY M. KOON, M.S. Waltham.
Extension Specialist in Vegetable Gardening; in charge of Market Garden Field Station, Waltham.

WILBUR H. THIES, M.S. Kendrick Place.
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HAROLD B. ROWE, B.S. South Amherst.
Extension Specialist in Agricultural Economics.

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ESTHER B. COOLEY, B.S. Sunderland.
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Mrs. HARRIET J. HAYNES, B.S. 62 Pleasant Street.
Assistant Extension Specialist in Home Economics.

Mrs. RUTH D. MORLEY, B.S. 23 Amity Street.
Assistant Extension Specialist in Child Development.

AGENTS IN COUNTIES.

BERTRAM TOMLINSON West Dennis.
Agricultural Agent.

MARY G. FLINT, B.S. Barnstable.
Home Demonstration Agent.

CARL A. FRASER, B.S. West Dennis.
Club Agent.

HARRY J. TALMAGE, B.S. Pittsfield.
Agricultural Agent.

SUSAN V. HILL, A.B. Pittsfield.
Home Demonstration Agent.

NELLIE E. CLOGSTON, B.S. Pittsfield.
Club Agent.

WARREN L. IDE, B.S. Segreganset.
Agricultural Agent.

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Home Demonstration Agent.

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Club Agent.

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Home Demonstration Agent.

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Club Agent.

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Agricultural Agent.

Mrs. LILLIAN M. S. CHASE Springfield.
Home Demonstration Agent.

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Club Agent.

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Agricultural Agent.

MARY POZZI Northampton.
Home Demonstration Agent.

HAROLD W. EASTMAN Northampton.
Club Agent.

ALLISTER F. MACDOUGALL, B.S. Concord.
Agricultural Agent.

REGINA M. FEENEY, B.S. Concord.
Home Demonstration Agent.

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Club Agent.

EARL M. RICKER, B.S. Walpole.
Agricultural Agent.

MARJORIE P. HOWE Walpole.
Home Demonstration Agent.

WILLARD G. PATTON Walpole.
Club Agent.

STANLEY L. FREEMAN, B.S. West Bridgewater.
Agricultural Agent.

MARY S. DEAN Brockton.
Home Demonstration Agent.

ROBERT B. EWING Campello.
Club Agent.

GEORGE F. E. STORY, B.S. Leicester.
Agricultural Agent.

MILDRED C. THOMAS Worcester.
Home Demonstration Agent.

MRS. ETHEL M. CROSS Worcester.
Club Agent.

The Library Staff.

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Librarian.

LENA V. CHAPMAN 3 Kendrick Place.
Assistant in charge of circulation.

JOAN L. COOKE 1 Taylor Street.
Library Assistant.

KATHERINE POWELL 6 Phillips Street.
Department Librarian.

BESSIE M. WEYMOUTH Butterfield Terrace.
Cataloguer.

Other Officers.

HOWARD BIDWELL Campus.
Engineer.

ELEANOR F. BISHOP 3 Spaulding Street.
Principal Bookkeeper, Treasurer's Office.

JOHN K. BROADFOOT 130 Pleasant Street.
Assistant Treasurer.

AFFIE M. COOK 13 Phillips Street.
Secretary to the President.

LAWRENCE S. DICKINSON, B.S. 2 Farview Way.
Superintendent of Grounds.

GRACE E. GALLOND Lincoln Block.
Assistant to the Dean.

MRS. CORA W. HATHAWAY Draper Hall.
Manager of the Dining Hall.

CLARENCE A. JEWETT 112 Pleasant Street.
Superintendent of Buildings.

JOHN J. LEE 38 Cottage Street.
Assistant to the Military Detail.

Mrs. Mary Macrae Infirmary.
Matron.

Mrs. Maud Marshall Abigail Adams House.
House Mother.

Enos J. Montague, B.S. Campus.
Farm Superintendent.

Elizabeth B. Strachan 17 High Street.
Principal Bookkeeper, Treasurer's Office.

Mrs. Edwin S. White Infirmary.
Resident Nurse.

STANDING COMMITTEES
1929-1930.

Committees of the Faculty.

Economic Status of Massachusetts Agriculture.

Professor A. H. Lindsey.
President Thatcher.
Director Munson.
Director Sievers.
Professor Branch.
Asst. Professor Mighell.
Mr. Rowe.

Library.

Professor Cance.
Director Sievers.
Professor Beaumont.
Professor Chamberlain.
Professor Shaw.
Professor Herr.
Professor Patterson.
Secretary Hawley.
Mr. Wood.

Massachusetts Agricultural Review.

Director Munson.
Director Verbeck.
Director Sievers.
Secretary Hawley.
Professor VanMeter.
Professor Fellers.
Asst. Professor Barrett.
Asst. Professor Knowlton.
Asst. Professor Banta.
Asst. Professor Derby.
Mr. Oleson.

Publications.

Director Sievers.
Director Fernald.
Director Munson.
Secretary Hawley.
Mr. Oleson.

Publicity.

Secretary Hawley.
Professor Cole.
Asst. Professor Montague.
Asst. Professor Derby.
Mr. Goodwin.
Mr. Oleson.
Mr. Carpenter.

Committees of the Teaching Staff.

Commencement.

Assoc. Professor Clark.
Treasurer Kenney.
Secretary Hawley.
Professor Chamberlain.
Asst. Professor Tucker.
Asst. Professor Snyder.
Mr. S. R. Parker.

Course of Study.

President Thatcher.
Dean Machmer.
Director Sievers.
Professor Waugh.
Professor Osmun.
Professor Gordon.
Professor Cance.
Professor Patterson.
Professor VanMeter.
Professor Skinner.
Professor Welles.
Professor Sanctuary.

Discipline.

Professor Mackimmie.
Dean Machmer.
Professor Gore.
Professor Gunness.
Asst. Professor Harrison.
Mrs. Hicks.

Employment.

Secretary Hawley.
Miss Hamlin.
Mr. Grayson.

Entrance Examination and Admission.

Dean Machmer.
Asst. Dean Lanphear.
Professor Julian.
Professor Glick.
Professor Powers.
Asst. Professor Serex.

Health and Sanitation.

Professor Hicks.
Professor Lentz.
Profesor Gore.
Professor Briscoe.

Music.

Asst. Professor Goding.
Assoc. Professor Rand.
Asst. Professor Cubbon.
Mr. Williams.
Mr. Smart.

Scholarship.

Dean Machmer.
Asst. Dean Lanphear.
Professor Mackimmie.
Professor Hicks.
Professor Skinner.
Professor Gage.
Professor Rice.
Assoc. Professor Rand.
Asst. Professor Torrey.

Student Housing.

Director Verbeck.
Treasurer Kenney.
Asst. Dean Lanphear.
Professor Skinner.
Mr. Williams.

Student Life.

Professor Thayer.
Asst. Professor Knowlton.
Asst. Professor Mack.
Asst. Professor Alderman.
Mr. French.
Mr. Salman.

Academic Activities Board.

Dean Machmer.
Asst. Professor Moore.

Athletic Board.

Dean Machmer.
Asst. Professor Markuson.
Asst. Professor Alexander.

Students' Major Advisory Committees.

Agriculture.

Director Sievers.
Professor Gunness.
Professor Sanctuary.
Professor Rice.
Asst. Professor Cubbon.
Asst. Professor Barrett.

Home Economics.

Professor Skinner.
Asst. Professor Knowlton.
Asst. Professor Tucker.

Social Sciences.

Professor Mackimmie.
Professor Cance.
Professor Patterson.
Professor Welles.
Asst. Professor Cutler.

Horticulture.

Professor Waugh.
Professor Chenoweth.
Professor Thompson.
Professor Thayer.
Asst. Professor Harrison.
Asst. Professor Snyder.
Mr. French.

Physical and Biological Science.

Professor Gordon.
Professor Ostrander.
Professor Fernald.
Professor Osmun.
Professor Chamberlain.
Professor Gage.
Professor Lentz.
Professor Powers.

GENERAL INFORMATION.

HISTORICAL SKETCH.

One of the outstanding achievements of the middle of the nineteenth century was the remarkable development in the field of science. This, in turn, brought about great changes in industry, transportation and agriculture and stimulated the desire for new information and further training. People were enthusiastic about the possibilities of the future. It is not surprising, therefore, that scientific courses gradually found their way into the academies and colleges. This was not without opposition from the friends of the old classical training, however. In many instances institutions founded along literary and philosophical lines did not favor the introduction of courses based on the needs of students desiring to perfect themselves in the technical principles and practice of the arts and industry. The demand for such courses increased, nevertheless. It was evident that the old order of education was changing but at the time the new was not apparent. It was under the above conditions that the Massachusetts Agricultural College had its birth.

The Morrill Act.

This demand for technical education finally crystallized into a bill known as the Morrill Act of 1862, endowing colleges for this purpose in every state of the Union. The original bill was framed by Senator Justin L. Morrill of Vermont and its final enactment obtained under his leadership. It provided that public land be assigned to the several states and territories, the funds from the sale of which were to be used to establish and maintain colleges of agriculture and mechanic arts. Although the main objective of such colleges was training in Agriculture and Mechanic Arts, they were to include other scientific and classical subjects in order to promote both the liberal and practical education of the industrial classes.

Massachusetts accepted the provisions of the Morrill Act in 1863 and immediately began to plan for a new college. The Massachusetts Institute of Technology was already organized, however, so it was decided that instruction in mechanic arts should be given there. For this reason the college, when founded, was one of agriculture only and today has the unique distinction of being the only separate agricultural college in the country. The General Court required that $75,000 be raised and presented to the Trustees by that town in which the college was to be located. Northampton, Lexington, Springfield and Amherst offered to comply with this request. After much discussion, Amherst was finally selected as the location and a tract of land containing 310 acres purchased for the college.

Founding and Early Growth of the College.

The institution was formally opened to students October 2, 1867. At that time there were four teachers on the faculty and four wooden buildings on the campus. The number of students steadily increased during the first term and by December 47 had been admitted. Of these members of the pioneer class of 1871 several are still alive. These men have seen the whole development of education in scientific agriculture for, at the time of their entrance into the college, technical training in this field was merely an idea, not yet even in the experimental stage. From this rather modest beginning, the college has grown steadily, not only in the field of resident instruction, but in that of research and in extension. In a sense, experimental work is as old as the institution, for during its earliest years some very important investigations were carried on by the instructors. Research work was established as a separate unit, however, in 1882 when the state provided for the establishment of an agricultural experiment station. This station which was

located at the college, was supplemented in 1887 by another, the Hatch Experiment Station, provided for under the Act of Congress establishing an experiment station in connection with agricultural colleges. These two stations were combined in 1895 and are now known as the Massachusetts Agricultural Experiment Station.

The scope of the college was further broadened with the establishment of the Extension Service. This aimed to make available to residents of Massachusetts useful and practical information in agriculture and home economics. It now serves those who are unable to take resident instruction in Amherst.

Present Scope of the College.

Thus, at the present, the college fulfills the three-fold purpose of instruction, research, and extension work.

The resident instruction in agriculture covers this field in its broadest sense. The college curriculum as now organized permits one to specialize in one of five fields, Agriculture, Home Economics, Horticulture, Physical and Biological Science, and Social Science. At the same time the student must pursue certain courses in each of the other groups so that his education becomes truly "both liberal and practical."

For those who have neither the preparation, the time or desire to pursue a collegiate course leading to a degree there are provided certain non-collegiate courses in practical agriculture. The Stockbridge School of Agriculture, located on the campus, offers a two-year course in practical agriculture. In addition there is a winter school course and a vocational poultry course.

In addition to this resident teaching there is the research work which attempts to accumulate new information in the broad field of agriculture and home economics. This information in turn is disseminated about the state to those unable to receive it through resident instruction, through the medium of the Extension Service.

THE COLLEGE CAMPUS.

Hand in hand with this steady growth of the College, there has come a marked expansion in physical equipment. The original farm of 1867, with its run-down fields and degenerated apple orchards cut up here and there by old Virginia rail fences and hedge rows has metamorphosed during the last fifty years into one of the most attractive college campuses in New England. A brief statement of land, buildings and equipment will show to what extent the original four wooden buildings have been out-grown.

Location and Lands.

The Agricultural College is located in Amherst, a town of about six thousand people, overlooking one of the most picturesque sections of the Connecticut Valley. From the standpoint of teaching material in the field of science and agriculture, the location is ideal. Amherst is ninety-seven miles from Boston and may be reached by the Central Massachusetts division of the Boston & Maine Railroad, or by the Central Vermont Railroad. Electric cars also connect the town with Northampton, Holyoke, and Springfield. The campus consists of a tract of approximately seven hundred acres, lying about a mile north of the village center. In addition the college owns another area of seven hundred and fifty-five acres located about six miles north of the campus on Mount Toby. This is used for a demonstration forest.

Buildings and Equipment.

The campus is laid out in the form of an oval attractively set off by the college pond in the center. Around this oval are grouped the main buildings of the college. In the following list the buildings are presented in order about this oval.

South College. — Here are located the administrative offices, including the office of the President, Dean, Treasurer, Secretary, the Extension Service, Short Courses, and Women's adviser. The Department of Agricultural Economics also has offices here. The west wing is used as a men's dormitory. This accommodates about twenty students. Erected 1885.

North College. — This is a men's dormitory which accommodates about thirty-five students. In addition there are the offices of the Christian Association and the Inter-Church Student Secretary, together with a large Social Union room used for meetings and entertainments. This is one of the oldest buildings on the campus, having been erected in 1867.

Flint Laboratory. — The work in Dairy Manufactures is carried on here. The building is well equipped with modern machinery for the production of market milk, ice-cream, butter and cheese. In addition there are the laboratories of Horticultural Manufactures for the scientific and economical preservation of food. This building was erected in 1911 and was named in honor of Charles L. Flint, fourth president of the college.

Stockbridge Hall. — Here are located the departments of Agronomy, Animal Husbandry, Agricultural Engineering, Farm Management, Poultry Husbandry, Education and English. In addition to the lecture rooms and offices are laboratories for soil fertility, field crops, poultry, and a drafting room for engineering. The clothing and house furnishing laboratories for the Home Economics Department are also located here. In the rear of the building are the greenhouse and head house used by the Department of Agronomy for work on crops and soils. A special reference library for the Division of Agriculture is on the second floor. Bowker Auditorium, the largest auditorium on the campus, is also in this building. It has a seating capacity of nine hundred and is named in honor of William H. Bowker, a member of the first graduating class, later a Trustee of the College, and one of the pioneers in the fertilizer industry. Stockbridge Hall was erected in 1914 and named in honor of Levi Stockbridge, a former president and professor of Agriculture in the college.

Grinnell Arena. — Such work in Animal Husbandry as pertains to livestock judging and study is carried on in the Grinnell Arena. This building erected in 1910, is located near the livestock barns and is especially designed for judging work.

Rural Engineering Shop. — Included in this laboratory for students of Rural Engineering, located a short distance back of Stockbridge Hall, are a carpenter shop, general repair shop, and a laboratory for farm machinery and motors. The building was erected from 1916 to 1924.

Draper Hall. — The college dining hall is located in Draper. The main dining room has a seating capacity of three hundred and seventy. In addition there is a cafeteria in the west wing which can accommodate about ninety-five at one time. The capacity of the dining hall during a normal meal hour is about six hundred although as many as one thousand can be accommodated. There is a small banquet room on the second floor and several dormitory rooms. Erected 1902 and subsequently, and named in honor of James Draper, for twenty years a trustee of the college.

Goessmann Laboratory. — This is a modern chemical laboratory. The building is approximately two hundred feet by eighty feet and contains eight large laboratory rooms, a large auditorium, a chemical library, and lecture rooms. The east wing of the third floor is occupied by the research professors in Chemistry of the Experiment Station. In addition to the work in Chemistry the class work in German is held in this building. Goessmann Laboratory was erected in 1924 and named in honor of Charles A. Goessmann, the first professor of Chemistry at the college.

West Experiment Station. — The state control work is centralized here. Fertilizers, seeds, and feeds are analyzed or inspected in accordance with the state law, to determine whether or not they meet their guarantee. Erected 1886.

East Experiment Station. — The office of the Director of the Experiment Station and other administrative offices of the Experiment Station are located in this building.

Abigail Adams House. — This is a modern girls' dormitory accommodating about one hundred students. It was erected in 1919 and named for Abigail Adams, a staunch believer in farm life, the wife of John Adams, second President of the United States. In the rear of the building is a large athletic field used in connection with the physical training work of the women students.

Bacteriology and Physiology Laboratory. — This building, erected in 1915, is

especially designed to carry on work in Bacteriology as it relates to soil, industry, dairying, foods and public health. There are four class laboratories, several private laboratory rooms and offices and a lecture room. In addition there are incubator rooms, sterilizing rooms, hood rooms, washing rooms, inoculating rooms, weighing rooms, an animal room, a photographic and dark room, and a sub-basement refrigerator room. There is also a well equipped library containing books and current periodicals useful in the conduct of bacteriological and physiological work and investigation.

Infirmary. — The Infirmary consists of two small cottages on the hillside in the rear of the Bacteriology Laboratory. They are especially designed to care for sick or injured students. A trained nurse is on duty at all times to assist in the needs of the patient.

Physics Building. — This is a small wooden building erected in 1867. It contains a well equipped laboratory for work in college Physics and also one lecture room.

Wilder Hall. — Here are located the departments for Landscape Gardening and Pomology. The building is chiefly devoted to classrooms, drafting rooms, and offices. It was erected in 1905 and named in honor of Marshall P. Wilder, a pioneer in the movement for agricultural education in Massachusetts and one of the first Trustees of the college.

Fisher Laboratory. — This is a well planned and equipped fruit packing and storage house. It includes six refrigerator rooms, four storage rooms not refrigerated, one large laboratory room, one class room besides ample storage space for fruit packages and equipment. The equipment for the building itself includes four types of apple sizers, packing tables and box and barrel presses of various types, besides all kinds of packages with smaller equipment necessary for thoroughly modern work in grading and packing fruit. This building is used by the Pomology Department and was named in honor of Jabez Fisher, one of the foremost, early horticulturists of the State. Erected 1910. Just east of Fisher Laboratory is the Horticultural Manufactures shed containing equipment for making cider, vinegar, and maple syrup.

French Hall. — French Hall houses the departments of Floriculture, Forestry, Horticulture and Vegetable Gardening. It is also the headquarters of the Northeastern Forest Experiment Station. The classroom work in Economics, Sociology, French and Spanish is also given here. Just to the rear of the building is the new Durfee range of greenhouses, devoted to the growing of carnations, roses, chrysanthemums, violets, etc. One house is maintained as a conservatory and contains a collection of plants used primarily for decorative purposes. Another house is devoted to greenhouse vegetables. The old Durfee range located just to the north of French Hall is used chiefly for the growing and maintenance of a collection of conservatory plants. There are also many of economic value such as the bamboo, camphor tree, guava, palm, etc. French Hall was erected in two sections; the first in 1908, the second in 1913. It was named in honor of Henry S. French, the first president of the college.

Clark Hall. — Here are located the offices, lecture rooms and laboratories of the Department of Botany. In addition to the main building, there is a greenhouse used for research and laboratory purposes. The herbarium contains about twenty thousand sheets of seed plants and ferns, twelve hundred sheets of liverworts and mosses and a collection of twenty-five thousand specimens of fungi. The office and laboratory of plant pathology of the Northeastern Forest Experiment Station also are located in this building. Erected in 1906 and named in honor of William S. Clark, president of the college and professor of Botany from 1867 to 1879.

Fernald Hall. — This building, erected in 1909, was named in honor of Professor Charles H. Fernald, who served the college for twenty-four years, built up a strong department in Zoölogy, created the department of Entomology, and acted as Director of the Graduate School. Fernald Hall houses the Departments of Zoölogy, Geology, and Entomology. In addition to laboratories, lecture rooms, and offices, there is a Geological Museum, a Zoölogical Museum and a collection of over 160,000 insects. Material in these collections is available for study and

for exhibition purposes. In the basement is located the cooking laboratory of the department of Home Economics.

Mathematics Building. — This is a small frame building containing classrooms for instruction in mathematics and surveying. There is also a well equipped drafting room, and a small one devoted to blue-printing.

Paige Laboratory. — The work in Veterinary Science is located in this building. In addition to the class, lecture, and laboratory rooms, there are the laboratories for the State Control and Research work on animal diseases. The museum contains a growing number of anatomical and pathological specimens most of which are used for teaching purposes. In the rear of the building are the stables for housing both laboratory and larger animals under isolation conditions for dissection, post mortem examinations and for incineration purposes. Paige Laboratory was erected in 1898 and named for James B. Paige, Professor of Veterinary Science from 1891 to 1922.

Drill Hall. — Here are located the offices of the Military and Physical Education Departments. Included is a basket ball floor, shower baths, lockers, and an indoor rifle range. The whole building was remodeled in 1927.

Alumni Field. — This tract of land was transformed into an Athletic Field, containing a baseball diamond, football field, and cinder track by the Alumni and friends of the college. Completed 1915.

Riding Park. — Just south of the Drill Hall is a small riding park used for exhibition purposes by the military unit.

Memorial Hall. — The social center of student life is Memorial Hall. It was erected by the Alumni, students, faculty and friends of the college in memory of those M. A. C. heroes who died in the World War. In the basement are bowling alleys, pool tables, a store, post office and barber shop. On the main floor are eight offices for the leaders of various student activities, a large reading room and a beautiful Memorial Room in which is found a tablet bearing the names of the sons of the college who gave their lives in the Great War. On the second floor is an auditorium seating 350 persons. This room is also used for college dances. Memorial Hall was erected in 1921.

Library. — This was originally the college chapel. It now contains one of the best agricultural libraries in the country. There are about 85,000 bound books together with a greater number of unbound books, pamphlets, magazines, etc. The collection covers the general field of agriculture, science, literature, history and sociology. The periodical file contains over 600 magazines and newspapers. The library is open during terms from 8 A.M. to 10 P.M. daily and from 1.30 to 4.30 and 7 to 9 P.M. Sundays, with shorter hours during vacation. This building was erected in 1885.

Power Plant. — Heat and light are supplied to all the buildings on the campus from a central power plant. This was erected in 1902 and has been subsequently remodeled.

Farm Buildings, Land and Equipment.

College Farm and Barns. — The college farm consists of 240 acres located just west of South College. Most of it is suitable for cultivation and is operated in regular rotation. Much of the farm as it now stands has been made productive by tile draining and clearing the land of brush and stumps. The principal crops raised are those which can be utilized by the livestock together with some cash crops such as cabbage, carrots, potatoes, and hay. For instructional work the farm is available for study in field crops, planning of crop rotation, practical field operation of farm machinery and tractors and farm management. The livestock of the farm consists of about 165 head of registered cattle which are excellent representatives of the Ayrshire, Guernsey, Holstein, Jersey, Milking Shorthorns, and Hereford breeds, a considerable number of registered Berkshire and Chester White swine, a flock of about 100 Shropshire and Southdown sheep and 20 Percheron horses. These animals are used chiefly for demonstrational and instructional work in feeding and herd management and in the teaching of correct types by much practice in judging. The farm buildings are model structures for their various purposes. They were erected in 1909 and subsequently. The dairy barns contain efficient and modern equipment for their

respective purposes. The sheep barns and piggery are located several hundred yards down from the dairy barns.

Cavalry Stable. — This stable has a capacity for the sixty horses which are used by the M. A. C. Cavalry troop. This building is maintained by Federal expense. Erected in 1925.

Poultry Plant. — The college poultry plant consists of about twenty acres of land in addition to the various buildings that go to make up a modern poultry plant. Although only eight acres of the land comprising the plant are college-owned this quantity permits for a three-year growing rotation. The plant will accommodate 2,000 laying birds and has growing facilities for about 7,000 chicks. The incubator capacity of the plant is approximately 12,000 eggs at one time. Located about one-half mile east of the college on East Pleasant Street, is the experimental poultry farm which accommodates about 1,200 adult birds and has hatching facilities for about 3,000 chicks. Here experiments on breeding poultry for egg production and disease control are carried on under strict quarantine.

The Hatch Barns. — These structures house the live stock which have been segregated from the main herd and flocks for the purpose of experimentation work in connection with the subject of feed and feeding. Erected in 1891.

Experiment Station Barns. — These buildings contain the equipment and animals used in connection with the work of the Massachusetts Experiment Station.

Orchards and Vineyards. — The college orchard contains about 20 varieties of peaches, 25 of plums, 20 of pears, and 100 of apples. Common varieties of grapes are grown in the vineyards and with the various approved trellis systems. These orchards are used for teaching material in Pomology.

Vegetable Gardens. — Here are grown the class material used by the vegetable gardening department.

Mt. Toby Demonstration Forest. — This is an area of approximately 750 acres located on Mt. Toby. It contains the various types of forest growth found throughout the State. It serves as a field laboratory in forestry. Students have the privilege of working out problems in silviculture, forest mensuration and management. Improvement cuttings, cuttings for utilization and forest planning are conducted here also.

COURSES OF INSTRUCTION.

Collegiate Courses.

Four-Year Collegiate Course. — The degree of Bachelor of Science is granted to those students satisfactorily completing the four years' work of collegiate grade.

The field of instruction covers Agriculture, Home Economics, Horticulture, Physical and Biological Sciences and Social Science.

Graduate School. — Students with the necessary qualifications may register in the Graduate School. The degrees of Master of Science, Master of Agriculture, Master of Landscape Architecture, Doctor of Philosophy, and Doctor of Agriculture may be granted upon the completion of satisfactory study, research, and a thesis.

Summer School. — Both graduate and undergraduate courses are offered in the six weeks' summer school. Only courses of collegiate grade are offered. Credits earned may count toward the Bachelor of Science degree or advanced degrees.

Non-Collegiate Courses.

Several short courses of non-collegiate grade are offered to meet the needs of those both young and old who through lack of preparation cannot qualify for the college course, or who desire only practical training in the modern accepted methods of farming. These courses are planned to help the farmer and the housewife.

Stockbridge School of Agriculture. — The purpose of this school is to provide a two-year course in practical agriculture for those who cannot meet the entrance requirements of a college course or who for other reasons cannot enroll for col-

legiate work. Study in this school is not equivalent to study in the college. Subjects taken in the Stockbridge School of Agriculture cannot be used for college credit.

The Winter School. — Beginning about January first a ten weeks' winter school is given. Practical courses in agriculture and horticulture are offered and are so arranged that a student may choose such subjects as will enable him to specialize along the line of work in which he is most interested.

One-Year Vocational Poultry Course. — This course is designed for those who wish an intensive course preparing them for practical poultry raising.

STUDENT EXPENSES.

Deposit Requirements.

Admission.

All collegiate undergraduate students are required to make a deposit of five dollars at the time of filing application for admission to the College. This deposit will be considered as payment of the matriculation fee at time of registration. The deposit will be refunded to all applicants who are rejected by the College. Any applicant who is accepted by the College but who fails to matriculate will forfeit the deposit.

Dormitory Rooms.

All students who apply for dormitory accommodations are required to deposit ten dollars at the time of making application. In case no accommodation is available this deposit will be refunded. It will be refunded if the Dean is notified before August 20 that the room will not be occupied. Otherwise it will be credited to the account of the student's room rent.

Note. Make all checks or money orders payable to Treasurer, M. A. C.

Tuition. — Residents of Massachusetts are charged a tuition fee of $60 per year, payable in advance in three installments of $20 each on the first day of each term. For those who are not residents of Massachusetts, the tuition fee is $180 per year. Students entering from Massachusetts are required to file with the Treasurer a statement signed by either town or city clerk, stating that the applicant's father is a legal resident of Massachusetts.

Matriculation Fee. — All students entering the college for the first time as undergraduates, are charged a matriculation fee of $5.00 which in the event of a student leaving the institution is returned, if all bills due the college are paid, or is, upon graduation, considered as payment for the diploma.

Rooms for Men. — Dormitory accommodations for men are available for about 62 students. Drawings for these rooms are made the latter part of May. Practically all such rooms are assigned to upper classmen at that time. Freshmen usually obtain rooms in private dwellings located near the campus. In most cases these rent for from $2.50 to $4 per week, depending somewhat on location, and whether or not they are single or double. Such rooms are usually furnished. Students desiring aid in obtaining rooms should write to the Assistant to the Dean. The college does not secure these rooms for the student but does keep a desirable list for student aid.

Rooms for Women. — Dormitory accommodations for women are available at the college for 105 girls. Applications for rooms should be made to the Adviser of Women. A freshman cannot be assigned to a room at the dormitory until her entrance record has been accepted by the Dean. A deposit of $10 is required when a room is reserved. The rental is $33 to $39 per term. Rooms in the dormitory are furnished except for necessary bedding or linen. They are cared for by the students occupying them.

Board. — All freshmen are required to board at the college dining hall. Upper classmen either board here or at private dining places. All women students living in college dormitories are required to board at the dining hall. The cost of board at the dining hall is $255 per year payable as follows:

At the opening of college	$79 00
December 1	18 50
January 2	82 50
March 31	75 00

Rebates at the rate of $6 per week may be granted for absences in excess of one week. No rebates will be allowed for absences of less than one week, unless the absence is authorized by the Dean, and the rebate approved by the Treasurer.

Additional Expenses. — In addition to the above charges there are additional expenses, such as laboratory fees, a military uniform deposit for those taking military drill, expenditures for books and stationery and certain class assessments and taxes levied for the maintenance of various organizations, such as the Social Union, Athletic Association, weekly publications, and so on.

Initial Payments. — The initial payment required of freshmen by the Treasurer's Office at the time of fall registration varies from about $100 to $150 depending on whether or not the student takes military and has a room in the dormitory.

Summary of Expenses. — The following is a summary of expenses for the year. The student should realize that these are strictly college expenses and do not include amounts for clothing, traveling, etc., expenses which vary with the individual.

ESTIMATE OF COLLEGE EXPENSES.

Tuition: citizens of Massachusetts, $60; others, $180 per year.

	Low	Normal
Tuition (citizens of Massachusetts)	$60 00	$60 00
Matriculation fee (first year)	5 00	5 00
Room in college dormitories or in private houses	39 00	140 00
Board, $7.50 per week (College Dining Hall)	255 00	255 00
Laundry, 50 to 85 cents a week	18 00	30 00
Laboratory fees	8 00	25 00
Books, stationery and miscellaneous item	40 00	60 00
	$425 00	$575 00

Graduation Requirement. — No student will be graduated unless all bills due the college are paid on or before the Wednesday preceding the graduation exercise. If paid after that date and otherwise eligible he may graduate the following year.

STUDENT EMPLOYMENT.

The college affords opportunity for part time employment for a limited number of needy students. The number of applicants for labor far exceeds the number that the institution can fill, however, so that no guarantee can be made that a student will find employment through the college. In many instances students find outside work through their own initiative. Among the permanent college positions are several janitorships. Forty or more students are employed at the dining hall. In addition the various college departments have work from time to time. Applications for student labor should be made to the Secretary of the College. Only those students are eligible for permanent campus employment whose need has been investigated by the employment committee and who have been certified as being eligible for such employment. Very few permanent campus positions are held by freshmen. For this reason freshmen are not advised to enter the college without at least $300 to $400 in cash; or enough to carry them the major portion of the year. Although they do find odd jobs about the college or town the amount of money that can be earned is usually small. Moreover, studies require practically all of the time of the beginning student. Students with insufficient funds are advised to work a year before entering college rather than attempt to carry too heavy a study and work load while in college. Those who elect military drill at the beginning of the junior

year are paid by the Federal Government at the rate of 30 cents per day while in college.

SCHOLARSHIPS.

Scholarships are awarded only to needy students of high character, whose habits of life are economical and who have maintained an average of at least 70% in their college course during the preceding year. Scholarships may also be granted to applicants for admission to the college provided they are candidates for a degree, are in need of financial assistance and are able to meet the entrance requirements in full. Complete information relative to the student's need for financial aid must be presented before any application can be acted upon. Scholarships are paid in installments at the beginning of each term in the form of a credit on the student's bill for that term. A scholarship may be discontinued at the close of any term if the scholastic record of the recipient is unsatisfactory.

Blanks for applying for a scholarship may be obtained from the Dean of the college. Applicants from the three upper classes must file at the Dean's Office before the close of the college year an account of their income and expenses for that college year together with a statement of their resources for the coming year. Prospective freshmen may file their applications at the time their entrance requirements are satisfied in full.

The following scholarships are available:

1. General scholarships:
 a. Nineteen scholarships of $60 each known as the Porter L. Newton Scholarships.
 b. One scholarship of $60 known as the Mary Robinson Scholarship.
 c. One scholarship of $60 known as the Henry Gassett Scholarship.
 d. One scholarship of $60 known as the Whiting Street Scholarship.
2. Scholarships limited to students from Berkshire County:
 a. At least ten scholarships of $60 or more, known as the Frederick G. Crane Scholarships.
3. Scholarships limited to men students of Hampshire County:
 a. Several scholarships known as the Wilbur H. H. Ward Scholarships.

The above scholarships are made available through the income of the following funds:

The Wilbur H. H. Ward Educational Trust Incorporated. — This is a gift of $100,000 from Wilbur H. H. Ward. The income is available for the assistance of needy boys first from Amherst and then from Hampshire County who attend the Massachusetts Agricultural College. This fund is administered by a Board of Trustees not connected with the college.

Frederick G. Crane Fund. — The family of the late Frederick G. Crane of Dalton has presented to the Massachusetts Agricultural College a gift of $25,000 to establish a fund in memory of Frederick G. Crane, the income therefrom to be expended by the Trustees in aid of worthy undergraduate students of limited financial resources attending the college, preference being given to residents of Berkshire County.

Porter L. Newton Fund. — This is a gift of $23,411 from the late Porter L. Newton of Waltham.

The Whiting Street Scholarship Fund. — This is a gift of $1,000 of Whiting Street of Northampton.

Mary Robinson Fund. — This is a gift of $1,000 from Miss Mary Robinson of Medford.

Gassett Scholarship Fund. — This is a gift of $1,000 from Henry Gassett of Boston.

LOANS.

Loans may be granted to needy students requiring some assistance in meeting the expenses of the college course. The student must present a properly endorsed note at the time a loan is made. Money thus loaned is at a low rate of interest until the student graduates or severs his connections with the college. Applications for a loan may be made at the Dean's Office.

These loans are made available through the income from the following funds:

Danforth Keyes Bangs Fund. — This is a gift of $6,000 from Louisa A. Baker of Amherst, the income of which is to be used annually in aiding poor, industrious and deserving students to obtain an education in the Massachusetts Agricultural College.

Charles A. Gleason Fund. — This is a gift of $5,000 from Charles A. Gleason of North Brookfield, Massachusetts, a trustee of the college from 1889 to his death, September 29, 1925.

Massachusetts Agricultural Club Fund. — The Massachusetts Agricultural Club has given $500 to be used as a loan fund at the Massachusetts Agricultural College to help out deserving students there who intend to go into agricultural work.

4-H Club Loan Fund for Boys. — A loan fund of $1,000.

4-H Club Loan Fund for Girls. — A loan fund of $100.

PRIZES AND AWARDS.

Prizes are offered annually in several departments for excellence in study and for other special achievements. The prizes offered in 1928 were:

The Grinnell Prizes. — Given by the Hon. William Claflin of Boston, in honor of George B. Grinnell, Esq., of New York, for excellence in theoretical and practical agriculture. The contest is open to those senior students whose records on the registrar's books show an average standing of 80 or above for the technical work taken in the Divisions of Agriculture and Horticulture during the junior and senior years. There are three prizes of $25, $15, and $10.

The Burnham Prizes. — These were made possible through the generosity of Mr. T. O. H. P. Burnham of Boston. Prizes of $15 and $10 are awarded to those students delivering the best and second best declamations in the Burnham contest. The preliminary contests are open under certain restrictions to freshmen and sophomores.

The Flint Prizes. — The Flint Oratorical Contest was established in 1881 by a gift of the late Charles S. Flint, a former trustee of the college. After his death the prizes were continued by college appropriation. Prizes of $30 and $15 are awarded as first and second prizes to those two students delivering the best orations in this contest.

The Hills Botanical Prize. — This is given through the generosity of Henry F. Hills of Amherst, for the first and second best herbaria. Competition is open to members of the senior, junior and sophomore classes. First prize $20, second prize $15.

The Allan Leon Pond Memorial Medal. — This medal is awarded for general excellence in football in memory of Allan Leon Pond of the class of 1920, who died February 26, 1920. He was a congenial companion, a devoted lover of Alma Mater, a battle-scarred, though youthful, veteran of the Great War, a fine all round athlete and a true amateur. He would rather win than lose, but he would rather play fair than win. He has been characterized as a typical "Aggie" man.

The Frederick Cornelius Eldred Memorial Athletic Prize. — This is a prize established by Frederick Cornelius Eldred of the class of 1873, famous oarsman and pioneer in athletics at M. A. C., who trained, coached and stroked crews for inter-collegiate races — two to victory. "A prize of one hundred dollars may be awarded at Commencement to that member of the senior class who has represented the college in intercollegiate athletic contests for a period not less than two years and who has attained the highest average standing in scholarship during his course."

Academic Conspicuous Service Trophy. — This trophy is awarded to that student who, during the past 12 months has made the most important, single contribution, to the Academic Activities.

The Southern Alumni Baseball Cup. — This cup is awarded to that member of the baseball team who contributes most to the success and reputation of the team, both in respect to skill and spirit.

Phi Kappa Phi Elections. — Those members of the senior class whose scholarship average has been 85 or above are eligible for election to the Honorary

Scholarship Society of Phi Kappa Phi. Not more than 15% of the class can be elected, however.

Phi Kappa Phi Award for Scholarship. — Massachusetts Chapter of the Phi Kappa Phi Honorary Scholarship Society offers an award for outstanding work in scholarship. This is given to some member of the Senior class at the opening of college in the fall. The award is based on the record of the first three years. For the college year 1927–1928 this scholarship was $250.

STUDENT ACTIVITIES AND ORGANIZATIONS.

No small part of the value received from four years of college is the training that one acquires through participation in student activities. Student organizations offer excellent opportunities for leadership in a wide variety of fields.

Student Government.

The Senate. — This is a student governing council. It is composed of representatives elected from the Junior and Senior classes. Besides acting as general director of undergraduate conduct it represents the interests of the students and the student body before the Faculty.

Adelphia. — This is a senior honorary society. The members are usually chosen from those who have been prominent in college activities. The society attempts in a quiet, unassuming way to mold student life on the campus.

The Honor Council. — The Honor System prevails at this college. The foreword of the Honor System reads as follows: "We, the students of the Massachusetts Agricultural College, believe that the goal of education is character. The man of character deals fairly with himself, and with others, and would rather suffer failure than stoop to fraud. The Honor System stands for this attitude in all relations of the students with the Faculty. In expression of our belief we pledge ourselves to the support of the constitution of the Honor System." Matters pertaining to the Honor System are in direct charge of the Student Honor Council, consisting of members elected from the four classes.

The Women's Student Council. — All appropriate matters pertaining to the conduct of women students are under the control of this council. It is composed of members selected from the senior, junior, and sophomore classes by all the women students.

College Publications.

The Massachusetts Collegian. — This is a weekly newspaper, published by the undergraduates of the college.

The Index. — This is the college yearbook published by the members of the Junior class.

The Alumni Bulletin. — This is the official organ of the Alumni of the college. It is issued from the office of the Alumni Secretary.

College Fraternities.

There are several national and local fraternities represented on the campus. Rushing rules and general matters dealing with fraternity life are in charge of the Inter-fraternity Conference. This conference awards scholarships, a baseball cup, and a relay placque to the winners of the Inter-fraternity Contests.

Academic Activities.

The College Musical Clubs include an orchestra, a Girls' Glee Club, and a Boys' Glee Club. These give a number of concerts during the year, both in Amherst and on tour.

The Dramatic Club, the Roister Doisters, presents annually a revue and two plays, one in connection with the Junior Promenade, and the other at Commencement. There is a Debating Society which conducts both class and intercollegiate debates. All academic activities are supervised by the Academic Activities Board composed of Alumni, Faculty, and students.

Inter-Collegiate Athletics.

The College is represented in inter-collegiate athletics by teams in all the leading sports, including football, baseball, track, hockey, and basketball. General policies governing athletics are in charge of the Athletic Board, composed of Alumni, Faculty, and students.

Professional Clubs.

There are several professional clubs established in connection with the major work of the college. Included among these is an Animal Husbandry Club, Landscape Art Club, Pomology Club, Agricultural Economics Club, and Floricultural Club.

Religious Organizations.

The Young Men's Christian Association and the Young Women's Christian Association are active both on the campus and off. In addition there is a Catholic Club, and a Jewish Menorah Society. The Cosmopolitan Club has as its object the cultivation of peace and the establishment of strong international friendship.

The Social Union.

The Social Union was established in 1907. All students become members of the Union by paying a small fee. In the fall and winter months the Union gives a series of entertainments.

HEALTH PROGRAM.

Physical Examinations. — All men students entering as freshmen are required to undergo a physical examination upon arrival at college. This examination is given during matriculation week. All women students entering as freshmen are required to present a health certificate. This involves a physical examination before coming to college.

The College Infirmary. — The college endeavors to safeguard the health of the students while on the campus. A resident nurse is on duty at the Infirmary at all times. Students are urged to go to the Infirmary at any time that they are in need of the services of such a nurse or of those of a town physician. Inasmuch as the Physical Director gives special attention to all student diseases it is to be expected that the majority of the students will go to the infirmary at his suggestion. This understanding should in no way deter students from going voluntarily at any time. Students are urged to consult the Physical Director or the resident nurse immediately when signs of physical disorder appear. Severe attacks of cold or other forms of illness can usually be avoided if treatment is administered in the incipient stage. The purpose of the infirmary is to help maintain the general good health of the students, as well as to furnish a suitable place for professional attention in cases of severe illness or accident. The infirmary fee will be at the rate of $2 per day and will be charged when one or more meals are obtained at the infirmary, or when the student remains at the infirmary for one or more nights. A nominal charge will be made to outpatients for miscellaneous treatment of a minor character. In addition to the above fees, additional expenses may be charged to the patient under certain conditions. In case a special nurse is required for the proper care of an individual, the services and board of this nurse will be paid by the patient, but the nurse will be under the general supervision of the resident nurse. If a student requires medical attention by a physician he will be required to select his physician and become responsible for fees charged by the physician. Special medical supplies prescribed by a physician or nurse will be charged to the patient. Expense for personal laundry incurred by students while in the infirmary will also be charged to the individual student.

FRESHMAN REGISTRATION.

All members of the incoming freshman class are required to be in residence on the campus for the period September 22 to September 27, 1930, inclusive. This period is known as Freshman Week. During this week will be given the several

psychological examinations and tests required of freshmen. In addition physical examinations will be given to the men students. Such matters as pertain to schedule and section assignments will be taken care of at the same time. Lectures on student activities, college customs, and college curriculum will be given also. The object of this week is to introduce the new student into the college, so that only the minimum amount of time will be lost when the actual studies begin.

STUDENT RELATIONS.

The customary high standard of college men and women in honor, manliness, self-respect and consideration for the rights of others constitutes the standards of student deportment.

The privileges of the college may be withdrawn from any student at any time, if such action is deemed advisable.

It should be understood that the college, acting through its president or any administrative officer designated by him, distinctly reserves the right, not only to suspend or dismiss students, but also to name conditions under which students may remain in the institution. For example, if a student is not doing creditable work he may not only be disciplined but he may also be required to meet certain prescribed conditions in respect to his studies, even though under the foregoing rules his status as a student be not affected. The same provision applies equally to the matter of absences ("cuts"). According to the rules a student is allowed a certain percentage of absences from class and other exercises. This permission, which implies a privilege and not a right, may be withdrawn at any time for any cause.

Similarly, also, it applies to participation in student activities. Though this will ordinarily be governed by the rules as already laid down, yet, if in the judgment of the college authorities, a student is neglecting his work on account of these activities, the privilege of participating in them may be withdrawn for such time as is considered necessary. Moreover, it may be withdrawn as a punishment for misconduct. Prospective students or their parents may, upon application, obtain a copy of the faculty rules governing student relations to the college.

SPECIAL APPOINTMENTS AT BOSTON.

A representative of the college will be at the State House in Boston, the second and fourth Thursday of each month from 1.30 to 4 o'clock in the afternoon. Any one desiring information in regard to entrance, courses, or other matters pertaining to college instruction can obtain a personal interview at that time by calling at the information office of the Department of Education. No guarantee of an interview is made, however, unless the appointment has been arranged for in advance by writing to the Dean of the College at Amherst, Massachusetts.

Admission to Collegiate Courses.

A. APPLICATION FOR ADMISSION.

Correspondence concerning admission should be addressed to the Dean's office.

Every applicant for admission to the college must be at least sixteen years old, and must present to the Dean proper testimonials of character, which, when ever possible, should come from the principal of the school at which the applicant has prepared for college. Candidates who desire to present themselves for examination in any subjects must make application to the college for such privilege at least one month before the date of the examination. Blanks for such application may be obtained by addressing the Dean of the college. All entrance credentials must be in the hands of the Dean before the applicant can matriculate.

B. MODES OF ADMISSION.

Students are admitted to the freshman class either upon certificate or upon examination. No *diploma* from a secondary school will be accepted.

Certificates. — The Massachusetts Agricultural College is affiliated with the New England College Entrance Certificate Board. Therefore certificates of admission will be accepted from schools approved by the Board. Certificates of admission will also be accepted from any Massachusetts school listed as class "A" by the State Department of Education, but not included in the approved lists of the New England College Entrance Certificate Board. Principals of schools in New England who desire the certificate privilege should address the secretary of the Board, Professor Frank W. Nicolson, Wesleyan University, Middletown, Conn. Certificates from schools outside of New England may be received if those schools are on the approved list of the leading colleges of the section in which the school in question is located.

The credentials of the Board of Regents of the State of New York are accepted as satisfying the entrance requirements of this college when offered subject for subject provided the grades are satisfactory.

Certificates in order to be accepted must present in the prescribed and restrictive elective groups at least three of the necessary fourteen and one-half units. It is to be understood, however, that responsibility for certification in either elementary French, elementary German, English 1 or English 2, Latin A, Greek A or Algebra, must be assumed by one school, if the candidate has received his preparation in any one subject named above in more than one school. Subjects lacking on certificate must be made up at the time of the examinations for admission. Conditions to the amount of two units will be allowed.

Blank forms for certification — sent to principals or school superintendents only — may be obtained on application to the Dean of the college.

Special Certificate Arrangement for Students from Agricultural Schools. — Superior graduates of Vocational Schools of Agriculture in Massachusetts and Vocational Agricultural Departments in Massachusetts High Schools may be accepted for the Degree of Vocational Agriculture provided: —

(*a*) they are unqualifiedly recommended by the Vocational Division of the Department of Education as *bona fide* Vocational Graduates with superior rank; and

(*b*) that they can present at least 14½ units of certified entrance, approved as to quality and quantity by the State Department of Vocational Education.

C. EXAMINATIONS.

Entrance examinations for admission to the Massachusetts Agricultural College will be held at the following centers: —

In June	Amherst, Stockbridge Hall, room 114. Cambridge, Massachusetts Institute of Technology.
In September	Amherst, Stockbridge Hall, room 114.

Please note that September examinations are held in Amherst only.

Schedule for Entrance Examinations June 19–21, 1930.

First Day.

8.30 A.M. Algebra.
10.30 A.M. Chemistry.
2.00 P.M. History (ancient, medieval and modern, English, United States and Civics).

Second Day.

8.30 A.M. English 1 and 2.
11.30 A.M. Botany and Biology.
2.00 P.M. Plane Geometry.
3.30 P.M. Physics.

Third Day.

8.30 A.M. French, German, Spanish, required and elective.
1.00 P.M. Latin, elementary, intermediate and advanced, and all one-half credit electives, except those already noted.

Schedule for Entrance Examinations September 17–20, 1930.

First Day.

2.15–5.00 P.M. Greek, elementary and intermediate.

Second Day.

8.30 A.M. Algebra.
10.30 A.M. Chemistry.
2.00 P.M. History (ancient, medieval and modern, English, United States and Civics).

Third Day.

8.30 A.M. English 1 and 2.
11.30 A.M. Botany and Biology.
2.00 P.M. Plane Geometry.
3.30 P.M. Physics.

Fourth Day.

8.30 A.M. French, German, Spanish, required and elective.
1.00 P.M. Latin, elementary, intermediate and advanced, and all one-half credit electives, except those already noted.

D. REQUIREMENTS FOR ADMISSION.

The requirements for admission are based on the completion of a four-year high school course or its equivalent and are stated in terms of units. A unit is the equivalent of at least four recitations a week for a school year.

Fourteen and one-half units must be offered for admission in accordance with the entrance requirements outlined below. In some instances students are allowed to enter conditioned in not more than two units.

Entrance Requirements.

1. *Prescribed.* — The following units are required.

Algebra	1½
Plane Geometry	1
English 1 (Grammar and Composition)	2
English 2 (Literature)	1
History	1
A foreign language	2
	8½

2. *Restricted electives.* — From two to six units selected from the following subjects: —

Mathematics and Science.

Solid Geometry	½
Trigonometry	½
Biology [1]	1
Botany [1]	½ or 1
Chemistry [1]	1
Geology	½
Physical Geography	½
Physics [1]	1
Physiology	½
Zoölogy [1]	½

History.

Ancient	1
English	1
Medieval and Modern	1
United States and Civics	1

Foreign Language.

Elementary French	2
Elementary German	2
Elementary Spanish	2
Elementary Latin	2
Elementary Greek	2
Intermediate French	1
Intermediate German	1
Intermediate Spanish	1
Intermediate Latin	1
Intermediate Greek	1
Advanced French	1
Advanced German	1
Advanced Spanish	1
Advanced Latin	1

3. *Free margin electives* — not over four units. In case fourteen and one-half units cannot be presented in the prescribed and restricted elective groups, units not to exceed four may be offered as free margin electives. Credit in the free margin will be allowed for any substantial courses (agriculture, general science

[1] Notebooks. — The keeping of a notebook is required as part of the preparation in those subjects indicated. Candidates presenting themselves for examination in such subjects must present at the same time a statement signed by the Principal to the effect that a satisfactory notebook has been kept by the candidate.

and fourth year English included) not listed under the prescribed and restricted elective groups for which credit of not less than one-half unit earned in one year is given toward a secondary school diploma. Since no entrance examinations are given in these subjects they may be offered only on certificate.

E. OTHER INFORMATION ABOUT ENTRANCE.

1. If elementary algebra and plane geometry are counted as three units the total requirement for admission will be fifteen.
2. Both the credits under the prescribed and restricted elective groups must be presented either by certificate from an approved school or by examination or by a combination of both. Credit by certificate will not be accepted unless at least three units are offered.
3. Candidates are allowed to spread their entrance examinations over the three consecutive periods just previous to their entrance into college. A period means June to September of the same year.
4. Examinations for the removal of entrance conditions will be held during the first week of the second term.
5. All entrance conditions must be satisfied before a student is permitted to enter upon the work of the sophomore year.
6. The privileges of the college may be withdrawn from any student at any time if such action is deemed advisable, regardless of whether entrance was gained by certificate or examination.
7. The passing grade for an entrance examination is 60 per cent.

F. ADMISSION TO ADVANCED STANDING.

A student desiring to transfer to this college from another of recognized standing must present the following credentials: —

1. A letter of honorable dismissal from the institution with which he has been connected.
2. A statement or certificate of his entrance record.
3. A statement from the proper officer showing a complete record of his work while in attendance.
4. A marked catalogue showing the courses pursued.
5. A statement from the proper officer, giving the total number of credits required for graduation by the institution from which the applicant is transferring, and, of this total, the number that the applicant has satisfactorily completed at the time of transfer.

The above credentials must be sent directly from the Registrar's office of the college from which the student is transferring. They should be addressed to the Dean of the Massachusetts Agricultural College. Applications will be judged wholly on their merits. The college may prescribe additional tests before accepting applicants or determining the standing to be granted them.

At least one year's work in residence is required of any student desiring to be recommended for the Bachelor of Science degree.

G. STATEMENT OF PREPARATION REQUIRED FOR ADMISSION.

Agriculture.

Entrance credit in agriculture is granted on the following basis: —

I. The Massachusetts Agricultural College accepts a maximum of four units in agriculture from any secondary or county agricultural high school in Massachusetts offering work in that subject, provided evidence of such work having been done is submitted on a principal's statement, as is indicated in the "free margin" group.

II. In high schools organizing agricultural club work under the supervision and rules of the junior extension service of the college, one credit is granted for each full year of work performed under the following plan: —

Work of the Winter Term. — (*a*) The study of textbooks such as are suitable for secondary school instruction in agriculture.

(*b*) Course of study: A general outline of suggested topics for study.

(*c*) Visits by a representative of the Massachusetts Agricultural College for observation, counsel and advice in regard to kind and amount of work being done in agriculture.

(*d*) Formation of an agricultural club with officers from among its own members, meeting once a month under local supervision of some one authorized to act for the school authorities.

Work of the Spring Term. — Same in general form as winter term.

Work of the Summer Term. — An approved project conforming to the rules of some one or more of the agricultural clubs of the junior extension service of the Massachusetts Agricultural College.

Work of the Fall Term. — (*a*) An exhibit of work.

(*b*) Reports and story of achievement submitted to the junior extension service of the college.

Biology.

The entrance examination in biology will cover the work outlined by the College Entrance Examination Board. This work should extend through one full year and include both laboratory and textbook study. The requirements are met by Hunter's *Civic Biology* and similar texts. A certificate stating that a satisfactory notebook has been prepared is required.

Botany.

For one unit of credit in botany, the work outlined in the statement of requirements issued by the College Entrance Examination Board, or its equivalent, will be accepted. This work should occupy one school year and include laboratory and supplementary textbook study. For one-half unit of credit, work that covers the same ground but occupies half the time required for a full unit of credit will be accepted. These requirements are met by such texts as Stevens' *Introduction to Botany* and Bergen & Davis' *Principles of Botany*. A notebook, containing neat, accurate drawings and descriptive records forms part of the requirement for either the half-unit or the one-unit credit, and this notebook must be presented by all applicants for admission upon examination in this subject. The careful preparation of an herbarium is recommended to all prospective students of this college, although the herbarium is not required.

Chemistry.

The entrance examination in chemistry will cover the work outlined by the College Entrance Examination Board as preparatory for college entrance. In general, this consists of a year of high school chemistry from any standard textbook, with laboratory work on the properties of the common elements and their simpler compounds. No particular work is prescribed. The keeping of a notebook is required.

A certificate stating that a satisfactory notebook has been kept should be submitted at the time of examination. In such a case it is not necessary to present the notebook. If the notebook is presented it must be certified.

Students who do not take chemistry in the preparatory school begin the subject in college.

Mathematics.

(*a*) *Required.* — Algebra: The four fundamental operations for rational algebraic expressions; factoring, determination of highest common factor and lowest common multiple by factoring; fractions, including complex fractions; ratio and proportion; linear equations, both numerical and literal, containing one or more unknown quantities; problems depending on linear equations; radicals, including the extraction of the square root of polynomials and numbers; exponents, including the fractional and negative; quadratic equations, both numerical and literal; simple cases of equations with one or more unknown quantities that can be solved by the methods of linear or quadratic equations; problems depending upon quadratic equations; the binomial theorem for positive integral exponents, the formulas for the *n*th term and the sum of the terms of arithmetic and geometric progressions, with applications.

Plane Geometry: The usual theorems and constructions of good textbooks, including the general properties of plane rectilinear figures; the circle and the measurement of angles; similar polygons; areas; regular polygons and the measurement of the circle; the solution of numerous original exercises, including loci problems; applications to the mensuration of lines and plane surfaces.

(*b*) *Elective.* — Solid Geometry: The usual theorems and constructions of good textbooks, including the relations of planes and lines in space; the properties and measurement of prisms, pyramids, cylinders and cones; the sphere and spherical triangle; the solution of numerous original exercises, including loci problems; applications to the mensuration of surfaces and solids.

Plane Trigonometry: A knowledge of the definitions and relations of trigonometric functions and of circular measurements and angles; proofs of the principal formulas and the application of these formulas to the transformation of the trigonometric functions; solution of trigonometric equations, the theory and use of logarithms, and the solution of right and oblique triangles.

Physics.

To satisfy the entrance requirement in physics, the equivalent of at least one unit of work is required. This work must consist of both classroom work and laboratory practice. The work covered in the classroom should be equal to that outlined in Hall & Bergen's *Textbook of Physics* or Millikan & Gale; the laboratory work should represent at least thirty-five experiments involving careful measurements, with accurate recording of each in laboratory notebook. This notebook, certified by the instructor in the subject, must be submitted by each candidate presenting himself for examination in physics; credit for passing the subject will be given on laboratory notes and on the examination submitted. Candidates entering on certificate will not be required to present notebooks, but the principal's certification must cover laboratory as well as classroom work.

Physiology.

Hough & Sedgwick's *The Human Mechanism;* Martin's *The Human Body; Briefer Course.*

Zoology, Physical Geography, Geology.

The following suggestions are made concerning preparation for admission in the subjects named above: —

For physiography, Davis' *Elementary Physical Geography;* Gilbert & Brigham's *Introduction to Physical Geography.* For zoölogy, textbooks entitled *Animals* or *Animal Studies,* by Jordan, Kellogg and Heath; Linville & Kelley's *A Textbook in General Zoölogy.* For geology, A. P. Brigham's *A Textbook of Geology* or Tarr's *Elementary Geology.*

Applicants for examination in zoölogy are *required* to present certified laboratory notebooks; applicants for examination in the other subjects are *advised* to present notebooks, if laboratory work has been done. Good notebooks may be given credit for entrance. Examination in these subjects will be general in recognition of the different methods of conducting courses; but students will be examined on the basis of the most thorough secondary school courses.

History.

The required unit must be offered in either ancient history, medieval and modern history, English history, or United States history and civics. Either one, two or three elective units in any of the historical subjects here named may be offered, provided that no unit be offered in the same subject in which the required unit has been offered.

Preparation in history will be satisfactory if made in accordance with the recommendations of the committee of seven of the American Historical Association, as outlined by the College Entrance Examination Board. The examination will require comparisons and the use of judgment by the candidate rather than the mere use of memory, and it will presuppose the use of good textbooks,

collateral reading and practice in written work. Geographical knowledge may be tested by requiring the location of places and movements on outline maps.

To indicate in a general way the character of the textbook work expected, the texts of the following authors are suggested: Botsford, Morey or Myers, in ancient history (to 814 A.D.); Adams, West or Myers, in medieval history; Montgomery, Larned or Cheyney, in English history; Fiske, together with MacLaughlin or Montgomery, in United States history and civics.

English.

The study of English in school has two objectives of equal importance: first, the ability to use the English language, in both speech and writing, clearly, correctly and effectively; and, second, the ability to read English literature with understanding and appreciation.

(1) *Grammar and Composition* (Two Units). — The first objective makes necessary a rigorous and reiterated instruction in grammar and composition, with special emphasis upon: spelling, sentence structure, punctuation and paragraph development. College freshmen are found deficient particularly in these fundamental phases of rhetoric.

(2) *Literature* (One Unit). — The second objective is sought by means of two lists of books, designated as *Books for Reading* and *Books for Study,* from which may be selected material for a progressive, four-year course in literature. The student should be trained to read aloud, to memorize significant passages, to associate the books with their historic background and to have well in hand both content and structure. He should be prepared for general examination on the former list and detailed examination on the latter. However accurate in subject matter, no paper will be considered satisfactory if seriously defective in punctuation, spelling or other essentials of good usage.

Lists of Books for 1929–1931.

1. Books for Reading.

From each group two selections are to be made, except that for any book in Group V a book from any other may be substituted.

Group I.

Cooper: *The Last of the Mohicans.*
Dickens: *A Tale of Two Cities.*
George Eliot: *The Mill on the Floss.*
Scott: *Ivanhoe* or *Quentin Durward.*
Stevenson: *Treasure Island* or *Kidnapped.*
Hawthorne: *The House of the Seven Gables.*

Group II.

Shakespeare: *The Merchant of Venice, Julius Caesar, King Henry V, As You Like It, The Tempest.*

Group III.

Scott: *The Lady of the Lake.*
Coleridge: *The Ancient Mariner;* and Arnold: *Sohrab and Rustum.*
A collection of representative verse, narrative and lyric.
Tennyson: *Idylls of the King* (any four).
The Æneid or *The Odyssey* in a translation of recognized excellence with the omission, if desired, of Books I–V, XV, and XVI of *The Odyssey,* or the *Iliad* with the omission, if desired, of books XI, XIII, XV and XXI.
Longfellow: *Tales of a Wayside Inn.*

Group IV.

The *Old Testament* (the chief narrative episodes in Genesis, Exodus, Joshua, Judges, Samuel, Kings and Daniel, together with the books of Ruth and Esther).

Irving: *The Sketch Book* (about 175 pages).
Addison and Steele: *The Sir Roger de Coverley Papers.*
Macaulay: *Lord Clive* or *History of England,* Chapter III.
Franklin: *Autobiography.*
Emerson: *Representative Men.*

Group V.

A modern novel.
A collection of short stories (about 150 pages).
A collection of contemporary verse (about 150 pages).
A collection of scientific writings (about 150 pages).
A collection of prose writings on matters of current interest (about 150 pages).
A selection of modern plays (about 150 pages).

All selections from this group should be works of recognized excellence.

2. Books for Study.

One selection is to be made from each of Groups I and II, and two from Group III.

Group I.

Shakespeare: *Macbeth, Hamlet.*

Group II.

Milton: *L'Allegro, Il Penseroso,* and either *Comus* or *Lycidas.*
Browning: *Cavalier Tunes, The Lost Leader, How They Brought the Good News from Ghent to Aix, Home Thoughts from Abroad, Home Thoughts from the Sea, Incident of the French Camp, Hervé Riel, Pheidippides, My Last Duchess, Up at a Villa — Down in the City, The Italian in England, The Patriot, The Pied Piper, De Gustibus, Instans Tyrannus, One Word More.*

Group III.

Burke: *Speech on Conciliation with America.*
Macaulay: *Life of Johnson.*
Lowell: *Democracy.*
Lincoln: *Speech at Cooper Union, his Farewell to the Citizens of Springfield, his brief addresses at Indianapolis, Albany and Trenton, the speeches in Independence Hall, the two Inaugural Addresses, the Gettysburg Speech, and his Last Public Address, together with a brief memoir or estimate of Lincoln.*
Carlyle: *Essay on Burns,* with a brief selection from Burns's poems.

FRENCH.

Elementary: The necessary preparation for this examination is stated in the description of the two-year course in elementary French recommended by the Modern Language Association, contained in the definition of requirements of the College Entrance Examination Board.

Third and fourth year French (elective subjects for admission). — For a third unit in French as an elective subject for entrance, the work heretofore described by the College Entrance Examination Board as "intermediate" is expected. For a fourth unit, the work described as "advanced" is expected.

No examination for a third unit in French will be given unless the candidate has presented elementary French on certificate, or has written the examination in elementary French.

No examination for a fourth unit in French will be given unless the candidate has presented both elementary and intermediate French upon certificate, or has written the examination in both elementary and intermediate French.

German.

Elementary: The entrance requirements in German conform to those of the College Entrance Examination Board for elementary German (the standard two-year requirements).

Third and fourth year German (elective subjects for admission). — For a third unit in German as an elective subject for entrance, when required units have been offered in German, the work heretofore described by the College Entrance Examination Board as "intermediate" is expected. For a fourth unit, the work described as "advanced" is expected.

No examination for a third unit in German will be given unless the candidate has presented elementary German upon certificate, or has written the examination in elementary German.

No examination for a fourth unit in German will be given unless the candidate has presented both elementary and intermediate German upon certificate, or has written the examination for both elementary and intermediate German.

Spanish.

Elementary: The necessary preparation for this examination is stated in the description of the two-year course in elementary Spanish recommended by the Modern Language Association, contained in the definition of requirements of the College Entrance Examination Board.

Third and fourth year Spanish (elective subjects for admission). — For a third unit in Spanish as an elective subject for entrance, the work heretofore described by the College Entrance Examination Board as "intermediate" is expected. For a fourth unit, the work described as "advanced" is expected.

No examination for a third unit in Spanish will be given unless the candidate has presented elementary Spanish on certificate, or has written the examination in elementary Spanish.

No examination for a fourth unit in Spanish will be given unless the candidate has presented both elementary and intermediate Spanish upon certificate, or has written the examination in both elementary and intermediate Spanish.

Greek.

Elementary — Greek grammar and composition: Translation into Greek of short sentences illustrating common principles of syntax.

The examination in grammar and prose composition will be based on the first four books of Xenophon's *Anabasis*.

Intermediate: Homer's *Iliad*, Books I and II (omitting Book II, 494 to end), and the Homeric forms, constructions, idioms and prosody.

Prose composition, consisting of continuous prose based on Xenophon, and other Attic prose of similar difficulty.

Translation of passages of Homer at sight.

The examinations in Greek, elementary and intermediate, will be given in September only.

Latin.

Elementary: Two credit units will be allowed if satisfactory proficiency is shown (including grammar) in (*a*) the translation of a passage or passages taken from Cæsar's *Gallic War*, covering at least four books, and (*b*) the translation of passages of Latin prose at sight.

Intermediate: Cicero (third oration *Against Catiline* and the orations *For Archias* and *For Marcellus*) and sight translation of prose.

Advanced: Vergil (*Æneid*, II, III and VI) and sight translation of poetry.

Collegiate Course of Instruction

The course of study consists of four years of work planned to provide scientific foundation, cultural background, and professional training, and leads to the degree of Bachelor of Science (B.S.). Except for a choice between French and German, the work of the freshman year consists of definitely required subjects.

The work of the sophomore year is also largely prescribed in order to insure a proper breadth of view of the several fields of study from which the student may select his further college work. Each student at the end of his freshman year selects one of the following major groups: Agriculture, Horticulture, Home Economics, Physical and Biological Sciences, or Social Sciences, and, under the guidance of a major group advisory committee, supplements the prescribed work of the sophomore year with certain elective courses which will best prepare him for further pursuit of this major course of study.

The work of the junior and senior years is, with certain restrictions, elective under the guidance of a special adviser, who is a member of the advisory committee of the major group which the student selects at the close of his freshman year as his field for professional training.

FRESHMAN YEAR.

Table of Freshman Subjects.

[Groups A and B of each term are required of all freshman men; groups A and C of all freshman women. For details, see the description of the courses and the following table.]

Groups.	Term I.	Term II.	Term III.
A	Agriculture 1 Chemistry 1 or 4 English 1 Modern Language (French or German) Mathematics 1	Agriculture 2 Chemistry 2 or 5 English 2 Modern Language (French or German) Mathematics 2	Agriculture 3 Botany 3 English 3 Modern Language (French or German) Mathematics 3
B	Military 1 Physical Education 1 Physical Education 2	Military 2	Military 3 Physical Education 3
C	Home Economics 1 Physical Education 4	Physical Education 5	Agriculture 6 Physical Education 6

SOPHOMORE YEAR.

Table of Sophomore Subjects.

[Groups A and B of each term are required of all sophomore men; groups A and C of all sophomore women. In addition each student will, with the guidance of his major advisory committee, select each term two additional courses (normally of three credits each). These elective courses should be so chosen as to insure breadth of training and proper prerequisites for the courses to be elected in the major group for the junior and senior years. For details, see the description of the courses (pages 44–97) and the following table.]

Groups.	Term I.	Term II.	Term III.
Required A	English 25 English 28 Economics 25 Physics 25 or Zoölogy 26	English 26 English 29 Agricultural Economics 26 Botany 25	English 27 English 30 History 30 Physics 27 or Physiology 33
B	Military 25 Physical Education 25	Military 26	Military 27 Physical Education 26
C	Physical Education 27	Physical Education 28	Physical Education 29
Elective	Agronomy 25[1] Agricultural Engineering 34[1] Drawing 25[3] Horticulture 25[3] Entomology 26[3] Physics 25[4] Zoölogy 26[2 4] French 1, 25, 28[5] German 1, 25, 28[5] History 28[5] Sociology 27[5] Home Economics 25[2] Home Economics 28[2]	Animal Husbandry 25[1] Agricultural Engineering 35[1 3] Drawing 26[3] Drawing 30[2] Horticulture 26[3] Bacteriology 30 Chemistry 25 Chemistry 30[2] Mathematics 26 Physics 26 French 2, 26, 29[5] German 2, 26, 29[5] History 25[5] History 29[5]	Agronomy 27[1 3] Agricultural Engineering 36[1] Animal Husbandry 26[1] Animal Husbandry 29[5] Drawing 27[3] Horticulture 27[3 5] Botany 26 Chemistry 26 Entomology 28 Mathematics 27 Physics 27 Physiology 33[2] French 3, 27, 30[5] German 3, 27, 30[5] Agricultural Education 29[5] Home Economics 30[2] Home Economics 32[2]

[1] Agriculture Group requirement.
[2] Home Economics Group requirement.
[3] Horticulture Group recommendation.
[4] Physical and Biological Science Group requirement.
[5] Social Science Group recommendation.

MAJORS: JUNIOR AND SENIOR YEARS.

[The following statement applies only to the class of 1930.]

General Statement.

A major consists of 60 credit hours of correlated work, which is arranged by the student and his adviser.

Rules Governing Majors.

Rule 1. *Election.* — Each student, before the first term of his junior year, shall elect a major subject, which shall consist of 60 credit hours of correlated work.

Rule 2. *Minimum Credits.* — The minimum number of credits for graduation shall be 120 junior-senior credit hours in addition to the satisfactory completion of the required courses of the freshman year and of the required and elective groups of the sophomore year.

Rule 3. *Maximum Credits.* — The maximum number of credits for any term of the junior or senior year shall be 22; the minimum shall be 18.

Rule 4. *Humanities and Rural Social Science.* — A minimum of 18 credit hours in the Divisions of the Humanities and Rural Social Science will be required of all students during their junior and senior years, with the following restriction: a minimum of 5 credit hours will be required in each of the divisions.

Rule 5. *Advisers.* — The work of each junior and senior will be under the immediate supervision of an instructor designated as major adviser. Ordinarily, the major adviser will be the head of the department in which the student elects his major. The adviser has full authority to prescribe the student's work up to 60 hours. He will, however, so far as practicable, recognize the individual needs of the student. It is also expected that students will seek the counsel of the adviser with respect to the remaining courses required for graduation.

Rule 6. *Free Electives.* — Each student during his junior and senior years is required to take 60 hours in his major and also 18 hours in the Divisions of the Humanities and Rural Social Science, making a total of 78 hours (but see Rule 4). He is allowed free choice of courses to complete his required hours.

Rule 7. *Registration.* — No junior or senior shall register until his major course of study is approved by his adviser.

(1) Course cards for recording the election of majors will be issued from the Schedule Room five weeks before the close of each term.

(2) This card must be submitted by each student to his major adviser, who will lay out the course for the succeeding term and countersign the card.

(3) Each course card must be filled out, giving the name of the student, his major, his class, and the name and address of parent or guardian. When the major courses have been entered on this card, and the hours of free elections added by the student, the card, accompanied by one hour plan, must be returned to the Schedule Room two weeks before the beginning of the final examination period.

Rule 8. *Change of Major.* — Applications for change of major may be made to the Dean in writing at any time; when approved by both major advisers concerned and by the Dean and the committee on scholarship, the change becomes operative at the beginning of the term following, provided that no change in the selection of a major may be made by any student after registration day of his senior year.

MAJOR GROUPS: JUNIOR AND SENIOR YEARS.

[The following statement applies to the class of 1931 and succeeding classes.]

General Statement.

The aim of the last two years is to give to each student as high a degree of proficiency in some one branch of learning as is possible without sacrificing the breadth of knowledge and training which should characterize a well-rounded college course. In order to insure this result, each student is required to complete, during his last two years of study, certain requirements for specialization within his major group and certain minimum requirements in other groups:

I. Agriculture: departments of Agricultural Engineering, Agronomy, Animal and Dairy Husbandry, Farm Management, Poultry Husbandry.

II. Home Economics: department of Home Economics.

III. Horticulture: departments of Floriculture, Forestry, Landscape Gardening, Horticultural Manufactures, Pomology, Vegetable Gardening.

IV. Physical and Biological Sciences: departments of Bacteriology and Physiology, Botany, Chemistry, Entomology, Mathematics and Civil Engineering, Physics, Veterinary Science, Zoölogy and Geology.

V. Social Sciences: departments of Agricultural Economics, Agricultural Education, Economics, History, and Sociology, Languages and Literatures.

For purposes of fulfilling the extra group requirements specified below, Groups I to III inclusive are regarded as a unit, since their work is comparable in field and character.

Specific Requirements.

Rule 1. *Credits for Graduation.* — The minimum number of credits for graduation shall be 108 junior-senior credit hours, in addition to the satisfactory completion of the required courses of the freshman year and of the required and elective groups of the sophomore year.

Rule 2. *Credits Each Term.* — Except upon special permission from the Scholarship Committee, no student shall enroll for more than 20 nor less than 16 credits each term of his junior and senior years.

Rule 3. *Specialization.* — At the close of his sophomore year each student shall designate some department within his major group in which he desires to specialize, and shall complete, during his junior and senior years, not less than 27 and not more than 54 credits in junior-senior courses offered in that department. In special cases, with the approval of the student's major adviser and the Dean, this requirement may be satisfied by the selection of at least the minimum number of credits from two or more departments of closely related work.

Rule 4. *Requirements in Other Groups.* — Each student shall complete, during his junior and senior years, not less than 9 credits in each of two groups other than his major group unit. That is, students pursuing a major in any one of Groups I to III, inclusive, must complete at least 9 credits each in Groups IV and V; students in Group IV must complete at least 9 credits each in Groups I to III, inclusive, and V; those in Group V, at least 9 credits in Groups I to III, inclusive, and IV.

Rule 5. *Credit in Military Science and Tactics.* Not to exceed 18 Junior-Senior credits in Military Science; may be included in the minimum requirements for graduation.

Rule 6. *Advisers.* — The work of each student will be under the general supervision of his major group advisory committee from the beginning of his sophomore year, and during his junior and senior years under the immediate supervision of a special adviser who shall be some member of that committee and shall represent the department in which the student is to specialize under the terms of Rule 3. The adviser has full authority to prescribe the student's work up to the maximum 72 credits required by Rules 3 and 4, and may advise the student with reference to his elections under Rule 7.

Rule 7. *Free Electives.* — Subject to the limitations imposed by Rules 2, 3, 4, and 5, each student may elect during his junior and senior years any courses offered in the catalogue for which he has the necessary prerequisite training.

Rule 8. *Registration.* — No junior or senior shall register until his course of study is approved by his adviser.

(1) A card for recording the election of courses will be issued from the Schedule Room five weeks before the close of each term.

(2) This card must be submitted by each student to his adviser, who will lay out the course for the succeeding term and countersign the card.

(3) This card, accompanied by one hour plan, must be returned to the Schedule Room two weeks before the beginning of the final examination period.

Rule 9. *Changing of Major Group.* — Application for change of major group can be made to the Dean in writing at any time; when approved by both major group advisory committees concerned and by the Dean and the Scholarship Committee, the change becomes operative at the beginning of the term following, provided that no change in the selection of a major group may be made by any student after registration day of his senior year.

Description of Courses.

[Heavy-faced Roman numerals indicate the term in which the course is given. Numbering of courses: 1 to 24, inclusive, freshmen; 25 to 49, inclusive, sophomores; 50 to 74, inclusive, juniors; 75 to 99, inclusive, seniors.]

DIVISION OF AGRICULTURE.

Agriculture.

Required Courses.

1. **I.** 2. **II.** 3. **III.** Agriculture. — Required course for all freshmen. A survey course, tracing the development of man as influenced by agriculture. It considers those problems which our complicated present-day civilization looks to agriculture to solve — problems practical, scientific, commercial, sociological. The object of the course is to give to students the agricultural concept and an appreciation of the close relationship of all lines of human activity to the great problems of agriculture.
2 class hours. Credit, 2.
Assistant Professor Lanphear.

6. **III.** Vocational Opportunities for Women. — For freshman women. An outline of the occupational progress of women, with special attention to the opportunities for women in those vocations for which the Massachusetts Agricultural College gives foundation preparation.
2 class hours. Credit, 2.
Miss Hamlin.

Agricultural Engineering.

Professor Gunness, Assistant Professor Markuson, Assistant Professor Tague, Mr. Pushee, Mr. Newlon.

The courses in agricultural engineering are planned to give a working knowledge of those phases of engineering which apply directly to the farm. It is expected that the student will acquire a clear understanding of modern farm practice as it relates to permanent improvements of the farm and the farmstead, and in the selection and use of farm equipment.

Elective Courses.

34. **I.** Power Engineering. — For sophomores; juniors and seniors may elect. This course deals with the application of power on the farm and in the home. A study is made of the various sources of power and methods of power transmission, including electric power. Through the solution of problems, the student gets a thorough training in that branch of mechanics which deals with power and hydraulics. A study of the principles of hydraulics as they affect water supply; power from streams; pumps for domestic, dairy, and irrigation purposes.
2 class hours. 1 2-hour laboratory period, credit, 3.
Assistant Professor Tague.

35. **II.** Heat Engineering. — For sophomores; juniors and seniors may elect. The purpose of this course is to acquaint the student with the principles involved in heating, refrigeration, and heat engines. A study is made of the various types of house heating systems; the application of heat, as in cooking and pasteurization; refrigeration as applied to dairy, cold storage, and house-

hold use; and the application of electricity to cooking and lighting. The course is taught chiefly by means of problems which call for a working knowledge of the principles involved.

2 class hours. 1 2-hour laboratory period, credit, 3.
Assistant Professor TAGUE.

36. **III.** MECHANICAL DRAWING AND BUILDING CONSTRUCTION. — For sophomores; juniors and seniors may elect. The exercises include lettering, geometric construction, orthographic projection, isometric drawing, and the making of working drawings of simple farm equipment. This course is for the agricultural student who wishes to learn the use of drawing instruments, the reading of blue prints, and some of the general practices of drafting valuable to every agriculturist. Instruction is given in building construction in order to teach the use of carpentry tools, to teach the economical use of building materials, and to give the elements involved in the framing of small structures. Students who contemplate taking Agricultural Engineering 75 will find this course helpful.

3 2-hour laboratory periods, credit, 3.
Laboratory fee, $1.00. Assistant Professor MARKUSON and Mr. PUSHEE.

50. **II.** FARM EQUIPMENT. — For juniors; others may elect. This course deals with the mechanical equipment of the farm, including care and repair of field implements. Practice is given in forge work, pipe fitting, soldering, and the use of machine tools. The purpose of this course is to acquaint the student with the place of up-to-date equipment on the farm and to give an appreciation of the factors involved in obtaining efficient use of this equipment.

1 class hour. 2 2-hour laboratory periods, credit, 3.
Laboratory fee, $1.00. Assistant Professor TAGUE and Mr. NEWLON.

51. **I.** RURAL SANITARY EQUIPMENT. — For juniors; seniors may elect. This course deals with the problems of providing water for farms, and means for disposal of sewage. A careful study is made of the different types of water systems and their adaptability to various conditions. The septic tank and other means of sewage disposal are studied.

2 class hours. 1 2-hour laboratory period, credit, 3.
The DEPARTMENT.

53. **II.** HOUSE PLANNING AND CONSTRUCTION. — For juniors; seniors may elect. Plan designs of the small house will be made. The arrangement of interior equipment, especially in the kitchen, lighting, heating, water supply, and sewage disposal will be studied, together with a brief history of the house, materials, construction methods, equipment, and architectural styles. Consideration will be given to the economics of house building, including financing, and to maintenance and overhead expense.

2 class hours. 2 2-hour laboratory periods, credit, 4.
Laboratory fee, $1.00. Assistant Professor MARKUSON.

75. **I.** FARM STRUCTURES. — For seniors; juniors may elect. A study of the strength and durability of concrete, wood, stone, and clay products, and of the mechanical principles underlying their use in farm construction. The design of various farm buildings, such as the general purpose barn, dairy stable, hog house, sheep barn, milk house, etc. In the drafting room, details of construction will be worked out, a study of the mechanics of simple roof trusses will be made, and a complete design of some major farm building will be finished in all essential details. Blueprints of the finished design will be made.

1 class hour. 2 2-hour laboratory periods, credit, 3.
Laboratory fee, $1.00. Assistant Professor MARKUSON.

78. **III.** FARM MOTORS. — For seniors; juniors may elect. This course deals with the gasoline engine as used for stationary work, automobiles, and tractors. The theory of the internal combustion engine is taken up in order to emphasize the effect of design and operation on power and economy. The various types of carburetors, ignition, and lubrication systems are studied in de-

tail. Instruction is given by means of lectures and textbooks, and by operating and repairing stationary engines, automobiles, and tractors. Special attention is given to overhauling and repairing.

3 class hours. 2 2-hour laboratory periods, credit, 5.
Laboratory fee, $1.00. Assistant Professor TAGUE and Mr. PUSHEE.

79. **III.** DRAINAGE AND IRRIGATION ENGINEERING. — For seniors; juniors may elect. The course covers the engineering phase of drainage and irrigation. The various systems are studied, and practice is given in the design of drainage and irrigation systems. Field work gives practice in surveying for drains, platting, locating drains, erecting batterboards, and laying tile. Practice is given in assembling equipment for spray irrigation, and the flow of water through nozzles is studied by means of laboratory tests.

1 class hour. 2 2-hour laboratory periods, credit, 3.
Assistant Professor MARKUSON.

81. **III.** DAIRY MECHANICS. — For juniors; seniors may elect. A study of dairy machinery, including steam boilers, engines, pumps, traps, refrigeration machinery, and heat-controlling devices. Practice is given in pipe fitting, packing valves, lacing belts, and similar repair jobs on the equipment used in dairy plants.

2 class hours. 1 2-hour laboratory period, credit, 3.
Assistant Professor TAGUE and Mr. NEWLON.

82. **I.** RURAL ELECTRIFICATION. — For seniors; juniors may elect. A study of the generation and distribution of electricity for light and power. Special emphasis is placed on the utilization of electricity on the farm and in rural communities.

2 class hours. 1 2-hour laboratory period, credit, 3.
The DEPARTMENT.

83. **I, II,** and **III.** AGRICULTURAL ENGINEERING PROBLEMS. — Open to seniors only. This course consists of individual problems chosen by the students under guidance of the department. The work is of an advanced nature, supplementing that of the regular agricultural engineering curriculum. Copy of project outline, indicating the number of credits, must be filed with the department and with the Dean at the opening of the term.

Credit, 3.
The DEPARTMENT.

Agronomy.

Professor BEAUMONT, Assistant Professor CUBBON, Mr. THAYER.

The courses in agronomy are designed to give instruction concerning the basic knowledge of the soil and its management, fertilizers and their use, and the principal products of the field. An important objective of our undergraduate teaching is to give supporting training to groups specializing in other departments. For undergraduates desiring to specialize in agronomy adequate courses are offered, but for those expecting to go into advanced educational or research work our graduate training is recommended as preferable.

Elective Courses.

25. **I.** FIELD CROPS. — For sophomores; juniors and seniors may elect. The course deals with the most important field crops of the world, but emphasizes those of special importance in New England.

2 class hours. 1 2-hour laboratory period, credit, 3.
Laboratory fee, $2.25. Assistant Professor CUBBON.

27. **III.** SOIL MANAGEMENT. — For sophomores; juniors and seniors may elect. An introductory course covering the properties and management of soils.

2 class hours. 1 2-hour laboratory period, credit, 3.
Laboratory fee, $2.25. Assistant Professor CUBBON.

50. **II.** Crop Production for Dairy and Stock Farms. — For juniors; seniors may elect. An intensive study of methods and problems of production of those field crops of greatest importance in the successful management of New England dairy and stock farms. Special attention will be given to the conditions found on the Massachusetts general farm, on which dairying and stock-raising are important.

2 class hours. 1 2-hour laboratory period, credit, 3.
Laboratory fee, $2.50. Assistant Professor Cubbon.
Prerequisite, Agronomy 27.

51. **III.** Advanced Field Crops (1930–31). — For juniors and seniors. This course is designed primarily for those specializing in field crops. Studies begun in Course 50 will be continued and extended to crops of importance beyond the range of New England. Theory and practice of crop improvement by plant breeding will be given attention. Given in alternate years.

2 class hours. 1 2-hour laboratory period, credit, 3.
Laboratory fee, $2.50. Assistant Professor Cubbon.
Prerequisite, Agronomy 50.

52. **I.** Soil Fertility. — For juniors; seniors may elect. A study of factors affecting soil fertility, with special attention to organic matter, soil reaction, and the use of fertilizers. Attempt will be made to meet the special needs of groups of students from other majors.

2 class hours. 1 2-hour laboratory period, credit, 3.
Assistant Professor Cubbon.

53. **III.** Soil Utilization. — For juniors; seniors may elect. Primarily for those not having had other courses in soils. Deals with the nature and properties of soil types, their adaptation to crops, and special problems arising in the management of extreme soil types.

3 class hours. Credit, 3.
Assistant Professor Cubbon.

77. **II.** Fertilizers. — For seniors; juniors may elect. A study of the source, properties, and behavior of commercial fertilizers and soil amendments. Attention will be given to such questions as home-mixed versus commercial fertilizers, the use of concentrated materials, and the economical purchase of fertilizers.

1 class hour. 2 2-hour laboratory periods, credit, 3.
Professor Beaumont.

78. **I.** Crop Improvement (1929–30). — For seniors; juniors may elect. Theory and practice of plant breeding and selection as applied to field crops. Given in alternate years.

2 class hours. 1 2-hour laboratory period, credit, 3.
Assistant Professor Cubbon.

80. **III.** Agronomic Literature. — For juniors and seniors in agronomy. Practice will be given the student in looking up original sources of agronomic knowledge and in preparing reports and abstracts.

3 class hours. Credit, 3.
Professor Beaumont.

Animal and Dairy Husbandry.

Professor Frandsen, Professor Rice, Assistant Professor Glatfelter, Assistant Professor Mack, Mr. Lindquist, Mr. Foley.*

Animal Husbandry.

The courses in animal husbandry are offered to meet the needs of students interested in the various phases of live-stock farming and market-milk production; agricultural college teaching; high and secondary school teaching; federal,

* Mr. Foley's appointment is temporary.

state, railroad, bank, or breed extension services; federal or state experiment station service; meat-packing industry; commercial feed industry.

Elective Courses.

25. **II.** Dairy Breeds. — For sophomores; juniors and seniors may elect. This course includes a survey of the dairy industry. The origin, history, development, and characteristics of the dairy breeds, and their adaptability to New England conditions are studied. Preliminary work in scoring animals according to the recognized standards is given, followed by comparative judging and placing.

2 class hours. 1 2-hour laboratory period, credit, 3.
Laboratory fee, $1.50. Professor Frandsen and Mr. Foley.

26. **III.** Horses, Swine, Sheep, and Beef Cattle. — For sophomores; juniors and seniors may elect. In this course consideration is given to the origin, history, development, and characteristics of the breeds of horses, swine, sheep, and beef cattle. Types, market classes, and grades of live stock are studied, together with their economic importance to the country in general, and to Massachusetts in particular. Preliminary work is given in scoring each type of animal, followed by judging and placing of groups.

2 class hours. 1 2-hour laboratory period, credit, 3.
Laboratory fee, $1.50. Assistant Professor Glatfelter.

29. **III.** Survey and Judging of Live Stock. — For sophomores; juniors and seniors may elect. This course includes a survey of the live stock industry. The origin, history, development, characteristics, distribution, and adaptability of each important breed of dairy cattle, beef cattle, sheep, swine, and horses are studied. Preliminary work in the scoring of pure-bred animals according to recognized standards is given, which is followed by considerable practice in judging and placing classes of live stock. This course is especially arranged for students enrolled in the Division of Social Sciences, and for others feeling a need for a general animal husbandry course.

2 class hours. 1 2-hour laboratory period, credit, 3.
Assistant Professor Glatfelter.

50. **I.** The Nutrition of Farm Animals. — For juniors; seniors may elect. This course consists of a study and application of the principles of physiological chemistry to the practical problems of animal feeding and growth. Consideration will be given to the chemical composition of plant and animal life; physiology of digestion; functions of vitamines, minerals, protein, and energy; feeding standards and their application; the composition of farm crops, their by-products, and commercially mixed feeds, and their utilization for the economical production of live stock and their products.

3 class hours. Credit, 3.
Professor Rice.

Prerequisites, Animal Husbandry 25 and 26.

51. **II.** The Feeding of Farm Animals. — For juniors; seniors may elect. A study of feeding practices as related to all classes of farm animals. This course is the complement of Course 50 and is for the purpose of demonstrating the applications of the science of nutrition to practical feeding problems. Considerable work will be given in the formulating of rations.

3 class hours. Credit, 3.
Assistant Professor Glatfelter.

Prerequisite, Animal Husbandry 50.

52. **III.** Advanced Live-stock Judging. — For juniors; seniors may elect. This course serves as a laboratory supplement to Animal Husbandry 53. It has three aims: (*a*) to train the student to see and evaluate differences in farm animals; (*b*) to begin the training of men who will act as judges of live stock at fairs; (*c*) to develop judging teams in both fat stock and dairy cattle to repre-

sent the college in the intercollegiate live-stock judging contest at the leading expositions. Trips will be taken each Saturday during the term to the leading herds and flocks in Massachusetts and nearby states. Approximate expense of travel is twenty-five dollars.

1 2-hour laboratory period on Friday, and all day Saturday, credit, 3.
Professor Rice.

Prerequisites, Animal Husbandry 25 and 26.

53. **III.** The Breeding and Improvement of Farm Animals. — For juniors; seniors may elect. This course is planned to give a broad view of the rise of many types and breeds from one ancestral stock; to note the origin, value, and permanence of certain variations; and to make clear the reasons for certain excellencies. The course also deals with the physiology of reproduction and with genetics, as a foundation for experience in actual production.
3 class hours. Credit, 3.
Professor Rice.

Prerequisites, Animal Husbandry 25 and 26; Zoölogy 26.

54. **II.** Meat and Meat Products. — For juniors; seniors may elect. This course deals with the manufacture of animals into their various commercial products and the distribution of these products to the consumer. Practice is given in the slaughtering of beef cattle, hogs, and sheep; judging of carcasses; cutting and curing of meats. The practical work is augmented by studies in the grading of fat stock, in packing house methods, in the magnitude and trends of the meat industry, and in the opportunities of local New England marketing.
1 class hour. 1 4-hour laboratory period, credit, 3.
Professor Rice and Mr. Foley.

75. **I.** Dairy Cattle and Milk Production. — For seniors. Consideration is given to the application of the principles of animal nutrition to the particular problems of dairy cattle feeding. Methods of feeding for high milk production are studied. Cost of milk production, and breeding and management problems are carefully considered. A survey is made of recent experiment station results.
2 class hours. 1 2-hour laboratory period, credit, 3.
Laboratory fee, $1.50. Professor Rice and Mr. Foley.
Prerequisites, Animal Husbandry 25, 50, 52, and 53.

76. **II.** Beef and Sheep Production. — For seniors. Application of the principles of nutrition is made to the feeding of beef cattle and sheep. Feeding, breeding, and management problems are considered. A survey is made of recent experiment station work, and special study is given to the opportunities for the Massachusetts farmer to produce high-quality beef and lamb.
2 class hours. 1 2-hour laboratory period, credit, 3.
Assistant Professor Glatfelter.
Prerequisites, Animal Husbandry 26, 50, and 52.

77. **III.** Horses and Swine Production. — For seniors. This course is planned to familiarize students with the application of the principles of nutrition to the feeding of horses and swine. Physiological and economic factors are considered in selecting suitable feeds. Cost of production, and breeding and managerial problems in commercial horse and pork production are considered. A study is also made of recent experiment station results in feeding, breeding, and management.
2 class hours. 1 2-hour laboratory period, credit, 3.
Professor Rice.
Prerequisites, Animal Husbandry 26, 50, 52, and 53.

80. **III.** Dairy Herd Management. — For seniors. The course includes a study of systems of dairy herd management; record form; methods of cost

accounting; fitting for production, show, and sale; cow testing and bull association work.
2 class hours. 1 2-hour laboratory period, credit, 3.
Professors Frandsen and Rice.

81. II. 82. III. Animal Husbandry Seminar. — Required of students majoring in animal husbandry. Students will prepare original papers and talks on various pertinent topics. Round table discussions of animal husbandry investigational work and practices will be conducted. Frequent addresses will be made to the class by prominent breeders and scientists.
1 class hour. Credit, 1.
Professors Frandsen and Rice.

Dairy Industry.

The courses in dairy industry are offered to meet the needs of students interested in the handling of market milk, and the science and art of butter making, ice-cream making, and cheese making; agricultural college teaching, and experiment station work; high and secondary school teaching; extension work; research and investigational work.

Elective Courses.

50. I. General Dairying. — For juniors; seniors may elect. A general course, prerequisite to all other dairying courses except 51 and 53, and for those who wish to take only one course in dairying to get a general knowledge of the subject. The work covers briefly: a study of milk, its secretion, composition, and various tests applied thereto; methods of handling milk and cream; the use of separators; elements of butter making, cheese making, and ice-cream making.
3 class hours. 2 2-hour laboratory periods, credit, 5.
Laboratory fee, $3.00. Professor Frandsen and Mr. Lindquist.

51. II. Judging Dairy Products. — For juniors; seniors may elect. A study of standards and grades of dairy products, with practice in judging milk and ice cream, as well as butter and cheese. The student learns to recognize quality in dairy products, to detect specific defects, and to know their causes and the means of their prevention.
Laboratory fee, $3.00. 1 2-hour laboratory period, credit, 1.
Assistant Professor Mack.

52. III. Market Milk. — For juniors; seniors may elect. A study of the various phases of the market milk industry: sanitary production, transportation, marketing, handling in the city plant, delivery systems, milk and its relation to the public health, inspection, milk laws, food value, and advertising. Some milk plants will be visited. The approximate expense of travel is five dollars.
3 class hours. 2 2-hour laboratory periods, credit, 5.
Laboratory fee, $3.00. Mr. Lindquist.
Prerequisite, Dairy 50.

53. III. Advanced Judging of Dairy Products. — For juniors; seniors may elect. The judging of milk, ice cream, butter, and cheese, using standard commercial methods and official score cards. A team is chosen from this class to represent the college in dairy products judging contests at the Eastern States Exposition and the National Dairy Show.
2 2-hour laboratory periods, credit, 2.
The Department.
Prerequisite, Dairy 51.

75. I. Milk Products (1929–30). — For juniors and seniors. The manufacture of milk products other than butter and ice cream, including cheddar cheese, soft and fancy cheese, condensed and powdered milk, casein, commercial

buttermilk, etc. Laboratory exercise largely in cheese making and commercial buttermilk manufacture. Given in alternate years.
1 class hour. 1 4-hour laboratory period, credit, 3.
Laboratory fee, $3.00. Mr. Lindquist.
Prerequisite, Dairy 50, previously or in conjunction.

76. I. Advanced Testing (1930–31). — For juniors and seniors. The work covers moisture and fat testing for all dairy products; the casein test; salt test for butter; acid tests; work with the Mojonnier apparatus; and many other applied chemical tests used in dairy manufactures work. Given in alternate years.
Laboratory fee, $3.00. 2 4-hour laboratory periods, credit, 4.
Assistant Professor Mack.
Prerequisite, Dairy 50, previously or in conjunction.

77. II. Butter Making (1930–31). — For juniors and seniors. A study of separators and cream separation; handling milk and cream for butter making; preparation of starters, and ripening cream; churning; markets and their requirements; marketing, scoring, and judging butter; creamery management; care of butter-making equipment; problems. Given in alternate years.
2 class hours. 2 3-hour laboratory periods, credit, 5.
Laboratory fee, $3.00. The Department.
Prerequisite, Dairying 50.

78. III. Ice-Cream Making (1929–30). — For juniors and seniors. A study of the principles and practice of ice-cream making. The laboratory instruction will cover commercial practices. Some ice-cream plants will be visited. The approximate expense of travel is five dollars. Given in alternate years.
2 class hours. 2 3-hour laboratory periods, credit, 5.
Laboratory fee, $3.00. Assistant Professor Mack.
Prerequisite, Dairying 50.

79. I. 80. III. Seminar. — For students majoring in dairy manufactures. This course consists of a study of the work accomplished by various experiment stations, also a review of foreign literature. Students will prepare papers on various dairy subjects. Frequent addresses will be made to the class by visiting dairy authorities.
1 class hour. Credit, 1.
Professor Frandsen.

Farm Management.

Professor Foord, Assistant Professor Barrett.

The purpose of the courses in this department is to train men to manage farms and other agricultural enterprises, as well as to prepare them for research and teaching in similar lines.

Elective Courses.

75. I. Farm Organization. — For seniors. A general course in the organization and business management of the farm. A study of regions and types of farming; the farmer as a business proprietor; funds for investment in the farm business; use of labor, land, equipment, and materials; selection and combination of factors of farm production. Discussions of the size of the farm business, farm balance, farm layout and arrangement.
2 class hours. 1 2-hour laboratory period, credit, 3.
Assistant Professor Barrett.
Prerequisite, the required sophomore work in agriculture or horticulture, or the permission of the instructor.

76. II. Farm Operation and Cost Accounting. — For seniors. A continuation of Course 75. A study of the means of production, and the selection and combination of farm enterprises. Discussions of the nature of farming costs,

the farmer's profits, and the farmer as a technical expert. The consideration of farm records and accounts as a basis for efficient operation.
2 class hours. 1 2-hour laboratory period, credit, 3.
Assistant Professor Barrett.

Prerequisite, Farm Management 75.

77. III. Advanced Farm Organization. — For seniors. A further and more specific study of the principles and practices outlined in Courses 75 and 76, with special reference to their application to farms in Massachusetts. Field trips are required. The approximate expense for travel is five dollars.
1 class hour. 1 4-hour laboratory period, credit, 3.
Assistant Professor Barrett.

Prerequisites, Farm Management 75 and 76.

78. II. 79. III. Seminar. — For seniors majoring in general agriculture; others by arrangement.
1 class hour. Credit, 1.
Professor Foord.

81. III. Types of Farming in the United States. — For seniors. A study of the agricultural regions of the United States and the different types and methods of farming carried on in each. The economic reasons for the establishment and maintenance of each type will be considered.
2 class hours. 1 2-hour laboratory period, credit, 3.
Professor Foord.

Poultry Husbandry.

Professor Graham, Professor Sanctuary, Assistant Professor Banta, Mr. Vondell.

The department aims to give instruction in the science, art, and practices of poultry keeping not only to the men majoring in this department, but also to students majoring in other departments and desiring supporting courses in poultry husbandry. Our major courses prepare men for the successful operation of commercial poultry farms and marketing projects either as owners or managers; for graduate work, teaching, extension and investigational work.

Elective Courses.

50. I. Poultry Judging. — For juniors; seniors may elect. A study of the origin and evolution of our standard breeds and varieties of domestic fowl; judging production quality, using trapnested birds; judging exhibition quality by score card and comparison. One or more poultry farms, an egg-laying contest, and a poultry show will be visited. Poultry judging teams competing in the inter-collegiate contest at Madison Square Garden each January are trained in this course. Not given 1929–30.
2 class hours. 2 2-hour laboratory periods, credit, 4.
Assistant Professor Banta.

51. II. Poultry Feeds and Feeding. — For juniors; seniors may elect. A study of the common feeds and the scientific principles underlying the field of nutrition. Recent experimental work and current feeding problems will receive special consideration. For observational practice and accumulation of original data, the management of a pen of birds will be required for a period of a few weeks. Not given 1929–30.
3 class hours. 2 2-hour laboratory periods, credit, 5.
Laboratory fee, $2.50. Assistant Professor Banta.

52. III. Incubation and Brooding. — For juniors; seniors may elect. A study of the fundamental principles underlying incubation and brooding practices. The science of physics and general biology is applied to the study of incubation and brooding processes. Students become thoroughly acquainted

with modern incubation and brooding equipment through detailed study and operation of typical incubators and brooders. Present-day problems are considered and some are investigated as a part of the class work. Not given 1929–30.

2 class hours. 2 2-hour laboratory periods, credit, 4.
Laboratory fee, $3.00. Mr. Vondell.

75. I. Poultry Housing and Sanitation. — For seniors. A consideration of the biological needs of poultry from the standpoint of housing, and the economic principles governing designing and construction of poultry houses and equipment for poultry farm buildings. The course also embodies a study of the principles of poultry sanitation, including external parasites and the insecticidal agents for their control.

3 class hours. Credit, 3.
Professor Sanctuary.

76. I. Market Poultry and Poultry Products. — For seniors. A study of market classes of poultry and eggs; preparation of poultry products for market; requirements of different markets; methods of marketing, involving a study of distribution, finances, and business organizations; cold storage and transportation; advertising, prices, and food values. Laboratory exercises in candling, packing, killing, dressing, and similar operations to make the above named factors more concrete. Students are required to fatten pens of chickens by different methods and rations, keeping accurate data of the gains in weight and quality, also the costs of feed and labor, and resultant profit or loss. Competitive judging of the exhibits in the Annual Market Poultry Show, staged by the members of this class, is a feature of the course. When possible, a short trip to Springfield is arranged to study cold storage plants and the handling of poultry products in the local market.

2 class hours. 1 2-hour laboratory period, credit, 3.
Laboratory fee, $2.00. Assistant Professor Banta.

77. II. Poultry Breeding. — For seniors. Methods of selection and improvement of poultry are developed through the study of the principles of heredity. Most of the course centers around the progeny test and pedigree method of breeding. Students taking this course participate in the college plant selection in pedigree work. Three breeds of poultry, each pedigreed for from seven to twenty years, furnish practice materials.

4 class hours. 1 2-hour laboratory period, credit, 5.
Laboratory fee, $2.00. Professor Sanctuary.

78. III. Farm Poultry. — For seniors; juniors may elect. For those students who desire a general knowledge of poultry husbandry but who cannot devote more than one term to the subject; it is not intended for students specializing in poultry, and such students are admitted only by special permission. Emphasis is placed on the farm flock and its economic management. Utility classification, housing, culling, feeding, hatching, rearing, production, marketing, and disease control receive special consideration.

3 class hours. 2 2-hour laboratory periods, credit, 5.
Assistant Professor Banta.

79. III. Poultry Farm Organization. — For seniors. This course embodies the application of economic and business principles to poultry farming. The place and importance of the various branches of well-organized poultry farms and their relation to each other receive special consideration; also the study of surveys and production costs. A trip covering two or three days will be made to representative successful poultry farms. The expense per student is approximately fifteen dollars. This trip is required of each student taking the course for credit.

2 class hours. 1 2-hour laboratory period, credit, 3.
Professor Sanctuary.

Prerequisite, Poultry 77.

80. **I, II,** and **III.** Poultry Problems. — Open to seniors only. This course consists of individual problems chosen by the students under guidance of the department. The work is of an advanced nature, supplementing that of the regular poultry curriculum. Copy of project outline, indicating the number of credits, must be filed with the department and with the Dean at the opening of the term.

Credit, 1 to 4.
The Department.

DIVISION OF HOME ECONOMICS.

Professor Skinner.

Home Economics.

Professor Skinner, Assistant Professor Knowlton, Assistant Professor Tucker.

The home economics courses offered are planned to meet the needs of (1) those students who are interested in education for homemaking as an integral part of the general education of women; (2) those who wish to enter a graduate school leading to professional work; (3) those who are interested in preparing for home economics extension service, both junior and adult; (4) those who are interested in professional or vocational work in which an understanding of home economics is fundamental, such as family or community welfare work, etc.; (5) those who wish to teach home economics, in which case certain elective courses should be chosen in the Department of Agricultural Education to secure a Massachusetts teacher's certificate. Other departments offer courses planned especially for students in home economics, as follows: House Planning and Construction in the Department of Agricultural Engineering; General Design in the Department of Landscape Gardening; and Food Preservation in the Department of Horticultural Manufactures.

Required Course.

1. **I.** Introduction to Home Economics. — For freshman women. Lectures on the history and evolution of the home; social customs and their value in family relationships; healthful and suitable care of the wardrobe; principles of nutrition as applied to the student's life; the student's budget, and the keeping of personal accounts.
2 class hours. Credit, 2.
Miss Skinner.

Elective Courses.

25. **I.** Clothing Appreciation and Design. — For sophomores; juniors and seniors may elect. Line, design, and color in relation to the college student's wardrobe will be studied. The care of clothing will also be included.
2 class hours. 1 2-hour laboratory period, credit, 3.
Laboratory fee, $1.00. Miss Tucker.

28. **I.** Clothing Selection and Construction. — For sophomores; juniors and seniors may elect. This course includes a study of the selection and purchase of suitable materials, of the use of commercial patterns, and of practical methods of making simple garments. The estimated cost of materials used is from five to ten dollars.
1 class hour. 2 2-hour laboratory periods, credit, 3.
Laboratory fee, $1.50. Miss Tucker.

30. **III.** Foods. — For sophomores; juniors and seniors may elect. A study of foods in their scientific and economic aspects, with the preparation of simple breakfasts and luncheons.
1 class hour. 2 3-hour laboratory periods, credit, 3.
Laboratory fee, $3.00. Miss Knowlton.

32. **III.** Applied Design. — For sophomores; juniors and seniors may elect. Applications of the principles of design are worked out in specific prob-

lems, using various media. Much opportunity is allowed for individual expression. The estimated cost of materials used is five dollars.

3 2-hour laboratory periods, credit, 3.
Miss Tucker.

Prerequisite, Drawing 30.

50. **I.** Foods. — For juniors; seniors may elect. A further study of foods on the basis of meal planning in the home, with especial emphasis on dinners and the day's meals as a whole.

2 class hours. 2 3-hour laboratory periods, credit, 5.
Laboratory fee, $4.00. Miss Knowlton.
Prerequisite, Home Economics 30, or permission of instructor.

51. **II.** Nutrition. — For juniors; seniors may elect. A study of the food requirement throughout infancy, childhood, adolescence, adult life, and old age, considering the energy value of foods and the nutritive properties of foodstuffs. Typical dietaries are planned for each period, with special regard to economic and social conditions.

2 class hours. 2 3-hour laboratory periods, credit, 5.
Laboratory fee, $2.00. Miss Knowlton.
Prerequisites, Home Economics 30 and 50; Chemistry 30.

56. **II.** Clothing and Textiles. — For juniors; seniors may elect. A study of the production, manufacture, identification, and use of the common textile fibers. Class trips to textile mills will be included, at an estimated expense of two dollars. Laboratory work in the construction of garments is used as a basis for a study of ready-made garments. The estimated cost of materials used is from five to ten dollars.

2 class hours. 2 3-hour laboratory periods, credit, 5.
Laboratory fee, $1.50. Miss Tucker.
Prerequisites, Home Economics 25 and 32; Drawing 30; Home Economics 28 is also prerequisite for those majoring in home economics.

58. **III.** General Course in Foods and Nutrition. — For juniors and seniors, not home economics majors, both men and women. A survey of the principles of food preparation, meal planning, and food values, with emphasis on the relation of good nutrition to health.

2 class hours. 2 3-hour laboratory periods, credit, 4.
Laboratory fee, $4.00. Miss Knowlton.

61. **III.** Home Furnishing. — For juniors; seniors may elect. A study of the fundamental principles which underlie the successful planning and furnishing of a satisfying home. Many applications of these principles are worked out in practical problems.

3 class hours. 2 2-hour laboratory periods, credit, 5.
Laboratory fee, $1.50. Miss Tucker.
Prerequisites, Drawing 30; Agricultural Engineering 53.

76. **I.** Home Management. — For seniors. The application of the principles of scientific management to the household, and the elements of successful home making. The family income, cost of living, household accounts, the budget and its apportionment. The responsibility of the woman to her family and the community in establishing right standards of living.

4 class hours. 1 2-hour laboratory period, credit, 5.
Miss Skinner.

77. **I, II,** and **III.** Home Management Practice. — For seniors. Students will live in the Home Management House for an interval varying in length from one-half term to one term, and study concrete problems in home management.

Credit, 3 or 5.
Miss Knowlton.
Prerequisites, Home Economics, 30, 50, 51, 61, 76, and the approval of the department.

78. **III.** Health, and Home Care of the Sick (1930–31). — Alternates with Course 80. For juniors and seniors. A study of the care of the family health; simple diseases and their prevention; the care of young children and invalids; first aid to the injured.
3 class hours. Credit, 3.
Miss Skinner.

79. **II.** Child Care and Training. — For seniors. This is a study of the physical and mental growth and development of the child, the rational care of children at various ages, the treatment in behavior problems, and the influence of environment in shaping personality.
3 class hours. Credit, 3.

80. **III.** Problems of the Family (1929–30). — Alternates with Course 78. For juniors and seniors. This course will consist of a study of the problems of family life in relation to the modern social organization. Its aim will be to develop an intelligent social consciousness and a sense of individual responsibility in family relationships.
3 class hours. Credit, 3.
Miss Skinner.

81. Methods of Teaching Home Economics. — For seniors, by arrangement with the head of the division. This course will discuss educational objectives as applied to the teaching of home economics in the junior and senior high schools, the psychological basis for teaching; evaluation of instructional material, selection and organization of subject matter; methods of teaching, and space and equipment.
2 class hours. 1 2-hour laboratory period, credit, 3.
The Department.
Prerequisite, Agricultural Education 56.

82. **II.** Problems in Elementary Nutrition. — For seniors. This course is intended to show how the home economics graduate fits into the health program of the school, either as a teacher or as a volunteer worker. Recommended only to those pursuing a major in home economics.
2 class hours. 1 2-hour laboratory period, credit, 3.
The Department.

83. **III.** Field Problems under Supervision. — For seniors. This course is intended to be a more intensive application of home economics to special community problems and to serve as a beginning of simple research work. Recommended only to those pursuing a major in home economics. Required trips, at an estimated cost of five dollars.
2 class hours. 1 2-hour laboratory period, credit, 3.
The Department.

85. **II.** Clothing Economics. — For seniors. This course includes a study of clothing budgets for college students and business women, and a critical analysis of sources of clothing information. Some special investigation is carried on by each student. Advanced work in garment construction is continued. The estimated cost of materials used is from seven to twelve dollars.
2 class hours. 2 3-hour laboratory periods, credit, 5.
Laboratory fee, $1.50. Miss Tucker.
Prerequisite, Home Economics 56.

DIVISION OF HORTICULTURE.

Professor Waugh.

Floriculture.

Professor Thayer, Assistant Professor Hubbard.

The courses in floriculture are intended to present a general knowledge of all phases of greenhouse design, construction, heating, and management, the culture of florists' crops (under glass and outdoors), floral decoration and arrange-

ment, and the marketing of plants and flowers. The department aims to train students so that they may take up various phases of commercial floriculture, positions in nursery establishments, and the management of conservatories on private estates, in parks and cemeteries.

Elective Courses.

50. **I.** Greenhouse Management. — For juniors; seniors may elect. Designed to familiarize students with the methods followed in the management of greenhouses and greenhouse crops, and the principles underlying the same; history and development of the floricultural industry; preparation of soils; fertilizers; potting; watering; ventilation; control of insects and diseases; methods of plant propagation; forcing of plants. At some time during the term the members of the class will be required to take a one-day trip to visit large commercial establishments. The approximate expense of the trip is five dollars. Lectures, assigned readings, reports, and laboratory practice.
2 class hours. 2 2-hour laboratory periods, credit, 4.
Laboratory fee, $1.50. Professor Thayer.
Prerequisites, Horticulture 25, 26, and 27.

51. **II.** Greenhouse Management. — For juniors; seniors may elect. Continuation of Course 50. Several field trips, to study floricultural establishments in the vicinity, will be made during the laboratory periods. The approximate expense of the trips is three dollars.
2 class hours. 1 4-hour laboratory period, credit, 4.
Laboratory fee, $1.50. Professor Thayer.
Prerequisite, Floriculture 50.

52. **III.** Floral Arrangement. — For juniors; seniors may elect. A study of the principles underlying the arrangement and use of cut flowers and plants; funeral designs, basket and vase arrangement, table decorations, home, church, and all interior decorations; a study of color as applied to such work. Lectures, assigned readings, and reports. This course is limited to ten students.
2 class hours. 2 2-hour laboratory periods, credit, 4.
Laboratory fee, $5.00. Professor Thayer.

53. **I.** Greenhouse Construction and Heating. — For juniors; seniors may elect. The location, types, arrangement, construction, cost, equipment, heating, and ventilating of greenhouse structures; the drawing of plans and study of specifications for commercial houses and conservatory ranges. Such practical work as glazing and the construction of concrete benches and cold frames is included as facilities allow. Lectures, assigned readings, and problems.
3 class hours. 1 2-hour laboratory period, credit, 4.
Laboratory fee, $1.00. Professor Thayer.

55. **III.** Garden Flowers and Bedding Plants. — For juniors and seniors. A study of the annuals, biennials, herbaceous perennials, bulbs, bedding plants, and roses that are valuable for use in floricultural or landscape gardening work. Methods of propagation, culture and uses of the various plants are considered; identification of material. Lectures, assigned readings, and reports.
2 class hours. 1 2-hour laboratory period, credit, 3.
Laboratory fee, $1.50. Professors Thayer and Hubbard.

75. **I.** 76. **II.** Commercial Floriculture. — For seniors. A detailed study of the cultural methods for the important commercial cut-flower crops and potted plants. Visits will be made to commercial establishments during the courses. The lectures are supplemented with textbooks and assigned readings.
2 class hours. 1 2-hour laboratory period, credit, 3.
Laboratory fee, $2.00 per term. Assistant Professor Hubbard.
Prerequisite, Floriculture 51.

77. **III.** Commercial Floriculture. — For seniors. The marketing of flowers and plants, including the management of wholesale markets and retail flower

stores; a study of systems of record keeping, cost analysis, inventory methods, and other phases of this important part of the floricultural industry.
2 class hours. 1 2-hour laboratory period, credit, 3.
Assistant Professor Hubbard.

Prerequisite, Floriculture 76.

79. **II.** Conservatory Plants (1930–31). — Alternates with Course 80. For juniors and seniors. A study of the foliage and flowering plants used in conservatory work; methods of propagation; assigned readings and reports.
2 class hours. 1 2-hour laboratory period, credit, 3.
Laboratory fee, $2.00. Professor Thayer.

80. **II.** Problems in Floriculture (1929–30). — Alternates with Course 79. For juniors and seniors majoring in floriculture. Advanced study of subjects pertaining to some phase of floriculture. All students are assigned specific problems and pursue study in these problems by reading and research. The results of this study must be presented in the form of a thesis. Discussions are conducted weekly.
1 class hour. 2 to 4 laboratory hours, not to exceed 3 credits.
Professor Thayer.

81. **III.** Seminar. — For seniors in floriculture. Presentation and discussion of research work in floriculture and other related fields, reports on assignments by individual members of the class, and the preparation of a thesis dealing with an assigned subject. Seminars are conducted weekly.
1 class hour. 2 to 4 laboratory hours, not to exceed 3 credits.
Professor Thayer.

Forestry.

Professor Grose.

The forestry courses are intended primarily for prospective owners or managers of farm woodlots, and the field work is focused on typical New England problems. These courses are broad enough, however, to furnish valuable preparation for students planning to study forestry in graduate schools.

Elective Courses.

55. **I.** Woodlot Forestry: Estimating and Business Management. — For juniors and seniors. Topics: forest mapping; timber cruising; determining rate of growth and possible cut; financial returns; forest taxation; our national timber supply, present and future.
1 2-hour and 1 4-hour laboratory period, credit, 3.
Laboratory fee, $1.00. Professor Grose.

56. **II.** Woodlot Forestry: Logging, Milling, and Marketing. — For juniors and seniors. Topics: felling trees; sawing logs; hauling logs; the portable mill; the stationary mill; seasoning, measuring, and shipping lumber; lumber grades and prices; legal forms; by-products of the woodlot; adaptability of species to uses; wood-using industries of Massachusetts.
2 class hours. 1 2-hour laboratory period, credit, 3.
Professor Grose.

Prerequisite, Forestry 55.

57. **III.** Woodlot Forestry: Timber-raising. — For juniors and seniors. Topics: forest planting; weeding; release cuttings; pruning; thinning; salvage cutting; protection from insects, fungi, fire, etc.; final cutting methods for natural reproduction of the forest.
1 2-hour and 1 4-hour laboratory period, credit, 3.
Laboratory fee, $1.00. Professor Grose.

58. **III.** Woodlot Forestry: Brief Survey. — For juniors and seniors. A condensation of Courses 55, 56, and 57 for those who have only one term to give to forestry.
2 class hours. 1 2-hour laboratory period, credit, 3.
Laboratory fee, $1.00. Professor Grose.

Horticultural Manufactures.

Professor Chenoweth, Mr. Griffiths.

The courses aim to give a knowledge of the practical problems connected with food preservation, with some skill in the manipulation of materials and equipment, together with a clear understanding of the scientific principles involved. Emphasis is placed upon the conservation of the cheaper grades of fruits and vegetables to the end that the entire crop may be marketed and that wholesome food may be produced from materials that would otherwise be lost. The social and economic values of this type of work and its relations to modern methods of living are emphasized.

Elective Courses.

75. **I.** Horticultural Manufactures. — For seniors and graduate students. A practical course in food preservation dealing primarily with fruits and vegetables. The canning of fruits and vegetables as practiced in the home and in commercial canneries. The manufacture of (*a*) fruit products, such as butters, jams, jellies, juices, marmalades, vinegars, etc., and (*b*) vegetable products, such as pickles, piccalilli, sauerkraut, etc. Particular attention is given to the study and use of all types of equipment suitable for the home or small factory, together with methods for testing and judging a large variety of manufactured products.
2 class hours. 3 2-hour laboratory periods, credit, 5.
Professor Chenoweth.

76. **II.** Horticultural Manufactures. — For seniors and graduate students. A continuation of Course 75. Emphasis is placed on the preservation of small fruits. A comparison of relative values of different varieties of small fruits for canning and manufacturing purposes. Judging of canned and manufactured fruit and vegetable products, together with a study of commercial grades and standards of canned foods.
1 class hour. 2 2-hour laboratory periods, credit, 3.
Professor Chenoweth.
Prerequisite, Horticultural Manufactures 75.

77. **III.** Horticultural Manufactures. — For seniors and graduate students. A continuation of Courses 75 and 76, dealing primarily with maple products and the canning of meats and the early spring vegetables. Also a study of special problems involved in establishing and operating home and farm factories. Visits to near-by farm factories and salting stations are required of all students.
2 2-hour laboratory periods, credit, 2.
Professor Chenoweth.
Prerequisites, Horticultural Manufactures 75 and 76.

78. **III.** Horticultural Manufactures. — For seniors and graduate students. Intended for the student who desires a broad, general knowledge of food preservation. A general course in food preservation, including lectures, readings, and laboratory exercises in the canning and drying of fruits and vegetables, and the manufacture of fruit and vegetable products. Emphasis is placed on the conservation of the low grades of fruits and vegetables in the home and the home factory.
2 class hours. 2 2-hour laboratory periods, credit, 4.
Professor Chenoweth and Mr. Griffiths.

80. **I.** Horticultural Manufactures. — For junior and senior women. A course dealing with the problems of food preservation in the home. Application

of present-day knowledge is made to the practices of canning, pickling, and manufacturing the autumn fruit and vegetable products.
2 class hours. 2 2-hour laboratory periods, credit, 4.
Professor Chenoweth and Mr. Griffiths.

81. II. Horticultural Manufactures. — For junior and senior women. A continuation of Course 80. The preservation of small fruits and the home storage of fruits and vegetables. The use of salt in the home preservation of vegetables, the manufacture of pickles, and the canning of meats and poultry will constitute the main work in this course.
1 class hour. 2 2-hour laboratory periods, credit, 3.
Professor Chenoweth and Mr. Griffiths.
Prerequisite, Horticultural Manufactures 80.

82. III. Special Fruit Products. — For seniors; juniors may elect. A laboratory course in the manufacture of preserved fruits, candied fruits, candy fillers, fruit pastes, fruit candies and other fruit specialties.
Class limited to 12 students.
2 2-hour laboratory periods, credit, 2.
Professor Chenoweth.

Horticulture.

Professor Waugh, Professor Thompson, Assistant Professor Drain, Mr. French.

The general subject of horticulture divides naturally into subjects of pomology, floriculture, forestry, landscape gardening, and vegetable gardening. A number of courses relate to more than one of these subjects, and are therefore grouped here under the general designation of horticulture.

Elective Courses.

25. I. Relationships and Associations of Horticultural Plants. — For sophomores. A study of the outstanding characters utilized in acquiring a practical knowledge of the principal species and varieties of cultivated plants, together with a consideration of those principles which determine the natural associations of plants in so far as they bear on the best methods of plant culture.
1 class hour. 2 2-hour laboratory periods, credit, 3.
Professor Thompson.

26. II. Horticultural Practices. — For sophomores. This course is designed to demonstrate and explain the principles underlying the practical cultivation of economic plants. Consideration will be given to the methods of propagation and to the culture of plants in their relation to soils, tillage, water, food supply, etc.
1 class hour. 2 2-hour laboratory periods, credit, 3.
Assistant Professor Drain.

27. III. Breeding of Horticultural Plants. — For sophomores. A study of the principles of inheritance as applied to plants, together with a consideration of the methods used and problems involved in the improvement of horticultural crops.
3 class hours. Credit, 3.
Mr. French.

50. I. Plant Materials. — For juniors; seniors may elect. The course aims to make the student familiar with the distinguishing characters of trees, shrubs, and woody vines used in ornamental plantings, together with the propagation and care of the same.
1 class hour. 2 2-hour laboratory periods, credit, 3.
Professor Thompson.

51. III. Plant Materials. — For juniors; seniors may elect. A continuation of Course 50, taking up the field uses of trees, shrubs, and woody climbers, their natural habitats, soils, and plant associations, with a view to supplying to the students in landscape gardening and floriculture a knowledge of the species and varieties used in ornamental planting. Frequent practicums and field excursions.

3 class hours. 2 2-hour laboratory periods, credit, 5.
Professor Thompson.

Prerequisite, Horticulture 50.

55. III. Advanced Plant Breeding. — For juniors; seniors may elect. An advanced study of experimental methods and biometry in plant breeding, Mendelian analysis, fluctuating variations, mutations, sterility, disease resistance, etc. Laboratory work in the experimental breeding of plants.

2 class hours. 1 2-hour laboratory period, credit, 3.
Mr. French.

Prerequisite, Horticulture 27.

75. III. Horticulture Review. — Required of all seniors majoring in the Division of Horticulture. Designed to correlate the various branches of plant science and horticultural practice.

1 lecture hour, 1 conference period. Credit, 2.
Professor Waugh.

Landscape Gardening.

Professor Waugh, Assistant Professor Harrison, Assistant Professor Gates.

The instruction in this department is aimed at two objectives: first, the contribution to general education; second, the preparation of men for the professional practice of landscape architecture The former objective seems important from the fact that landscape gardening offers an excellent opportunity for the practical discussion of the principles underlying all the fine arts. In the professional courses students are prepared, as well as time permits, to begin work in landscape architecture which leads through field experience or post-graduate study to permanent establishment in that profession.

Drawing.

Elective Courses.

25. I. Free-Hand Drawing. — For sophomores; juniors and seniors may elect. Lettering; free-hand perspective; sketching from models; laying flat and graded washes in water colors; water-color rendering of leaves, flowers, and trees.

3 2-hour laboratory periods, credit, 3.
Laboratory fee, $1.50. Assistant Professor Gates.

26. II. Mechanical Drawing. — For sophomores; juniors and seniors may elect. Inking exercises; geometric problems; isometric projection; intersections; shades and shadows; parallel, angular, and oblique perspectives; perspective drawings of buildings. Students should have preparation in plane and solid geometry.

3 2-hour laboratory periods, credit, 3.
Laboratory fee, $1.50. Assistant Professor Gates.

27. III. Elementary Design. — For sophomores; juniors and seniors may elect. Introduction to the principles of pure design, with various applications, especially in the field of landscape gardening.

3 2-hour laboratory periods, credit, 3.
Laboratory fee, $1.50. Professor Waugh.
Prerequisites, Drawing 25 and 26.

30. II. Elementary Design. — For sophomore women. Elementary principles of design, with application to costume design, interior decoration, etc.

3 2-hour laboratory periods, credit, 3.
Laboratory fee, $1.50. Assistant Professor Gates.

Landscape Gardening.

Elective Courses.

50. I. Mapping and Topography. — For juniors. Reconnoissance and topographical surveys and mapping, with special reference to the methods used in landscape gardening. Must be followed by Course 51.

2 2-hour and 2 3-hour laboratory periods, credit, 5.
Laboratory fee, $2.00. Assistant Professor Harrison.
Prerequisites, Mathematics 26 and 27; Drawing 25, 26, and 27.

51. II. Elements of Landscape Gardening. — For juniors. Study of the engineering details of landscape gardening; grade design, road design, drainage, play areas, etc.

3 3-hour laboratory periods, credit, 4.
Laboratory fee, $2.00. Assistant Professor Harrison.
Prerequisite, Landscape Gardening 50.

52. III. General Design. — For juniors. Detailed study of selected designs of leading landscape gardeners. Field notes; examination of completed works and those under construction; design of architectural details; written reports on individual problems.

2 2-hour and 2 3-hour laboratory periods, credit, 5.
Laboratory fee, $2.00. Assistant Professor Harrison.
Prerequisites, Landscape Gardening 50 and 51, and either plant materials (Horticulture 50) or advanced mathematics.

53. II. Garden Design. — For juniors; seniors may elect. The elementary principles of structural design as applied to the simpler garden forms — the so-called "natural" and "formal" styles; other garden forms.

1 class hour. 3 2-hour laboratory periods, credit, 4.
Laboratory fee, $2.00. Professor Waugh.
Prerequisite, Landscape Gardening 50.

75. I. Theory of Landscape Art. — For seniors and graduates. The general theory and application of landscape study.

3 class hours. Credit, 3.
Professor Waugh.

76. III. Civic Art. — For seniors. The principles and applications of modern civic art, including city planning, city improvement, and rural improvement, with special emphasis upon country planning.

3 3-hour laboratory periods, credit, 4.
Laboratory fee, $2.00. The Department.
Prerequisites, Landscape Gardening 52 and 53.

78. II. Architecture (1930–31). — Alternates with Course 79. For juniors and seniors. The history of architectural development, the different historic types, with special reference to the underlying principles of construction and their relation to landscape design. Illustrated lectures, field trips, the study of details, preparation of plates.

3 class hours. Credit, 3.
Assistant Professor Harrison.

79. **II.** Construction and Maintenance (1929–30). — Alternates with Course 78. For juniors and seniors. Detailed instruction in staking out work; methods of construction and planting; organization, reporting, accounting, estimating, etc.
3 class hours. Credit, 3.
Assistant Professor Harrison.

81. **I.** Residence Grounds Design. — For seniors. Grading and planting plans; garden designs and planting.
3 3-hour laboratory periods, credit, 4.
Laboratory fee, $2.00. Assistant Professor Harrison.
Prerequisites, Landscape Gardening 52 and 53.

82. **II.** Advanced Design. — For seniors. A series of problems in the design of estates, parks, and small property.
3 3-hour laboratory periods, credit, 4.
Laboratory fee, $2.00. Assistant Professor Gates.
Prerequisite, Landscape Gardening 81.

83. **III.** Park Design. — For seniors. Studies in modern park designs of various types.
3 3-hour laboratory periods, credit, 4.
Laboratory fee, $2.00. Assistant Professor Harrison.
Prerequisite, Landscape Gardening 82.

Pomology.

Professor Sears, Professor Van Meter, Assistant Professor Drain, Mr. French, Mr. Roberts.

It is the object of the courses in pomology to give the student a thoroughly practical training, so that he may be able to perform or supervise all of the different operations in connection with the growing and marketing of the various fruits. At the same time he is given a thorough grounding in the scientific principles on which the practical work is based, in order that he may better understand the various practices taught.

Elective Courses.

53. **I.** General Pomology. — For juniors; seniors may elect. A study of the most approved practices in fruit production. Textbooks, lectures, and reference books; field and laboratory exercises.
2 class hours. 1 2-hour laboratory period, credit, 3.
Professor Sears and Mr. Roberts.

54. **II.** Systematic Pomology. — For juniors; seniors may elect. A study of varieties of fruits, including identification, nomenclature, relationships, and classification. This course is advised but not required of candidates for the varsity fruit judging team. Lectures, textbooks, laboratory and field exercises.
1 class hour. 2 2-hour laboratory periods, credit, 3.
Laboratory fee, $4.00. Assistant Professor Drain.
Prerequisite, Horticulture 27.

55. **III.** Small Fruits. — For juniors; seniors may elect. A study of the growing of small fruits, including raspberries, blackberries, strawberries, currants, blueberries, and grapes, dealing with such questions as propagation, selecting a site for the plantation, soils, fertilizers, pruning, harvesting, marketing, etc.
2 class hours. 1 2-hour laboratory period, credit, 3.
Mr. French.
Prerequisite, Horticulture 27.

56. **III.** Spraying. — For juniors; seniors may elect. (*a*) Spraying materials, their composition, manufacture, and preparation for use; the desirable and objectionable qualities of each material; formulas used, cost, tests of purity. (*b*) Spraying machinery, including all the principal types of pumps, nozzles,

hose, and vehicles; their structure and care. (*c*) Orchard methods in the application of the various materials used, with the important considerations for spraying each fruit and for combating each orchard pest. This course is designed especially to familiarize the student with the practical details of actual spraying work in the orchard. Spray materials are prepared, spraying apparatus is examined and tested, old pumps are overhauled and repaired, and the actual spraying is done in the college orchards and small-fruit plantations.

1 class hour. 2 2-hour laboratory periods, credit, 3.
Assistant Professor DRAIN.

Prerequisite, Pomology 53.

75. I. SYSTEMATIC POMOLOGY. — For seniors. A continuation of Course 54, with special reference to nursery variety certification, variety study of pears, grapes, plums, cherries, strawberries, raspberries, blueberries, and blackberries.

1 class hour. 3 2-hour laboratory periods, credit, 4.
Laboratory fee, $4.00. Assistant Professor DRAIN.
Prerequisite, Pomology 54.

77. I. COMMERCIAL POMOLOGY. — For seniors. The picking, handling, storing, and marketing of fruits, including a discussion of storage houses, fruit packages, and methods of grading and packing. Special emphasis is placed upon laboratory and field work, where the student is given actual practice in the picking and packing of most of the principal fruits.

1 class hour. 2 2-hour laboratory periods, credit, 3.
Mr. ROBERTS.

Prerequisite, Pomology 53.

80. I. 81. II. 82. III. SEMINAR. — For seniors majoring in pomology. Advanced study of problems relating to the business of fruit growing. Each student is assigned a major problem in lines of work in which he is particularly interested. He pursues his studies both by reading and research, and the materials obtained will be worked into theses, which are presented to the seminar for discussion. No lectures are given, but seminar meetings are held for one period each week.

1 class hour. Credit, 1.
The DEPARTMENT.

83. II. GEOGRAPHY AND ECONOMIC PROBLEMS OF THE FRUIT INDUSTRY. — For seniors; juniors may elect. This course considers the leading American and foreign centers of fruit production as they affect our own fruit industry through competition here or abroad. Particular reference is made to the economic position of fruit growing in New England and to the major factors influencing the industry here. The distribution of production costs in New England is studied with relation to costs in other regions and to the details of orchard management.

3 class hours. Credit, 3.
Professor VAN METER.

Prerequisite, Pomology 53.

84. II. ADVANCED POMOLOGY. — For seniors. A critical survey of the scientific principles underlying orchard practices, with especial attention to recent research work in fruit growing. Textbooks, lectures, assigned readings, and field exercises.

2 class hours. 1 2-hour laboratory period, credit, 3.
Professor SEARS and Mr. ROBERTS.

Prerequisite, Pomology 53.

85. III. ADVANCED POMOLOGY. — For seniors. As stated under Course 84.

3 class hours. Credit, 3.
Professor SEARS and Mr. ROBERTS.

Prerequisite, Pomology 84.

Olericulture.

Professor Waugh, Assistant Professor Snyder and Mr. Beach.

The purpose of the courses is to train men (1) for all the commercial branches of vegetable and seed production, and (2) for the professional fields of research, extension work, and teaching.

Elective Courses.

50. **III.** General Olericulture. — For juniors; seniors may elect. A general consideration of fundamentals in vegetable production which may be applied to the growing of vegetables as a cash crop with other types of agriculture, the growing of vegetables in the home garden, agricultural instruction in secondary schools, and professional agricultural work other than teaching.
2 class hours. 1 2-hour laboratory period, credit, 3.
Laboratory fee, $2.00. Assistant Professor Snyder.

51. **I.** Olericulture. — For juniors; seniors may elect. A study of the principles underlying vegetable production; the vegetable plant, soil and its treatment, plant food, seed, and seedage.
2 class hours. 1 2-hour laboratory period, credit, 3.
Assistant Professor Snyder.

52. **II.** Olericulture. — For juniors; seniors may elect. A study of the principles underlying vegetable production; the vegetable plant and its responses to environmental conditions.
2 class hours. 1 2-hour laboratory period, credit, 3.
Laboratory fee, $2.00. Mr. Beach.

53. **III.** Olericulture. — For juniors; seniors may elect. A study of the principles underlying vegetable production; methods of culture, storage, marketing, and pest control.
2 class hours. 1 2-hour laboratory period, credit, 3.
Laboratory fee, $2.00. Assistant Professor Snyder.
Prerequisite, Olericulture 50, 51, or 52.

75. **I.** Systematic Olericulture. — For seniors. A critical study of variety identification; nomenclature and classification; judging and exhibiting.
2 class hours. 2 2-hour laboratory periods, credit, 4.
Laboratory fee, $3.00. Assistant Professor Snyder.

76. **II.** Olericulture of Greenhouse Crops. — For seniors. A study of the principles underlying the culture of vegetables under glass.
2 class hours. 1 2-hour laboratory period, credit, 3.
Laboratory fee, $2.00. Assistant Professor Snyder.

77. **III.** Commercial Olericulture. — For seniors. A critical study of the fundamental problems in the commercial production of vegetables. Visits to the leading market and truck sections in the state are required. Twenty-five dollars will cover such trips.
2 class hours. 1 2-hour laboratory period, credit, 3.
Assistant Professor Snyder.
Prerequisite, Olericulture 50, 51, or 52.

DIVISION OF SCIENCE.

Professor Gordon.

Bacteriology and Physiology.

Professor Gage, Assistant Professor Bradley, Miss Garvey.

The courses in bacteriology and physiology have been planned to furnish: (1) general training in these subjects for all college students, (2) training for those interested in agriculture, industries, and domestic science, (3) training for prospective students of human or veterinary medicine and public health, (4)

training for teachers and laboratory workers in the biological sciences. The courses in bacteriology include introductory and general courses, and advanced work, most of which precedes the applied bacteriology of agriculture, the arts, industry, domestic science, and public health. The course in physiology includes considerations of modern ideas on this subject in relation to human welfare.

Bacteriology.

Elective Courses.

30. **II.** Introductory Bacteriology. — For sophomores. As stated under Course 50.

2 3-hour laboratory periods, credit, 3.
Laboratory fee, $5.00. Assistant Professor Bradley and Miss Garvey.

50. **II.** Introductory and General Bacteriology. — For juniors; seniors may elect. Designed to make micro-organisms real and significant. An attempt is made to demonstrate their wide distribution and relationship to agriculture, arts, science, industries, and medicine. The course aims to provide an elementary basis for bacteriological study and interpretation and to furnish such material as will be valuable in understanding agriculture, domestic science, and public health problems.

2 3-hour laboratory periods, credit, 3.
Laboratory fee, $5.00. Assistant Professor Bradley and Miss Garvey.

51. **III.** Differential Bacteriology. — For juniors; seniors may elect. Morphological, cultural, and physiological aspects of micro-organisms are considered. Types of bacteria, their classification and identification, and their functions are studied. This course is fundamental to all advanced and extended microbiological studies.

2 3-hour laboratory periods, credit, 3.
Laboratory fee, $5.00. Professor Gage and Miss Garvey.
Prerequisite, Bacteriology 30 or 50.

60. **I.** Public Health. — For juniors; seniors may elect. Considers the relation of the human body to its environment in the maintenance of health and the production of disease. This study is based upon human anatomy and physiology. The individual, as a member of society, governed by natural laws, is also of fundamental importance. Animal and human diseases of public health significance are reviewed, their control considered, and their social values discussed.
3 class hours. Credit, 3.
Professor Gage.

61. **II.** Public Health. — For juniors; seniors may elect. Public health laws, organization, and the laboratory in relation to public health projects will be discussed. Vital statistics and their significance will be considered.
3 class hours. Credit, 3.
Professor Gage.

Prerequisite, Bacteriology 60.

62. **III.** Public Health. — For juniors; seniors may elect. Sanitation and its relation to agriculture and public health. The microbiological features of air, water, soil, sewage, refuse, and the control of municipal and rural sanitary projects will be considered.
3 class hours. Credit, 3.
Assistant Professor Bradley.

Prerequisite, Bacteriology 61.

75. **I.** Advanced Bacteriology. — For seniors; juniors may elect. This course will include advanced studies in the differentiation of micro-organisms, including serology as applied to classification and diagnosis. This course pre-

pares for the study of more advanced agricultural, domestic science, and public health problems.

10 laboratory hours, credit, 5.
Laboratory fee, $5.00. Professor Gage and Miss Garvey.
Prerequisite, Bacteriology 51.

82. I. Soil Bacteriology. — For seniors; juniors may elect. Such subjects as the number and development of micro-organisms in different soils; the factors which influence their growth; food, reaction, temperature, moisture, and aeration; the changes wrought upon inorganic and organic matter in the production of soil fertility, ammonification, nitrification, and denitrification; fixation of nitrogen symbiotically and non-symbiotically; methods of soil inoculation receive attention.

2 3-hour laboratory periods, credit, 3.
Laboratory fee, $5.00 Assistant Professor Bradley and Miss Garvey.
Prerequisite, Bacteriology 50.

81. II. Food Bacteriology. — For seniors; juniors may elect. A study of the principles of food preservation and food conservation by means of drying, canning, refrigerating, and addition of chemicals. Food fermentations, as illustrated by bread, vinegar, etc., are examined. Decomposition of foods, as may be seen in meat, oysters, fish, milk, etc., as well as diseased and poisonous foods, receive consideration. Contamination of food supplies by means of water, sewage, handling, exposure, diseased persons, etc., is of especial significance and is demonstrated by laboratory exercises. Laboratory inspection of foods is now a subject of great import and is given attention.

2 3-hour laboratory periods, credit, 3.
Laboratory fee, $5.00. Assistant Professor Bradley and Miss Garvey.
Prerequisite, Bacteriology 50.

80. III. Dairy Bacteriology. — For seniors; juniors may elect. Special emphasis is placed upon milk supplies. The microbial content of milk, its source, its significance, its control; microbial taints and changes in milk; groups or types of organisms found in milk; milk as a carrier of disease-producing organisms; the value of clarification, centrifugal separation, temperature, pasteurization; the abnormal fermentations of milk; bacteriological milk standards and their interpretation; ripening of milk and cream; the bacterial content of butter; a survey of the microbiology of cheeses; a study of special dairy products, such as ice cream and artificial milk drinks.

2 3-hour laboratory periods, credit, 3.
Laboratory fee, $5.00. Assistant Professor Bradley and Miss Garvey.
Prerequisite, Bacteriology 50.

Physiology.

Elective Courses.

33. III. General Physiology. — For sophomores; juniors and seniors may elect. As stated under Course 63.
2 class hours. 1 2-hour laboratory period, credit, 3.
Professor Gage.

63. I. General Physiology. — For juniors; seniors may elect. The object of this course shall be to adapt the elements of physiology to the modern viewpoint. The relationship and influence of experimental biology, physical chemistry, and biochemistry upon physiology will be considered. The course is planned as an introductory course for those who wish to study physiology in its essentials but lack extensive preparation. Applications and demonstrations will be made of the practical side of nutrition, exercise, mental work, fatigue, and respiration, as they relate to conservation of human and animal life.
2 class hours. 1 2-hour laboratory period, credit, 3.
Professor Gage.

64. II. General Physiology. — For juniors; seniors may elect. Physiology of nutrition with special reference to intermediate and basal metabolism. Introductory work on nerves and nerve action, and a more detailed consideration of internal and external respiration.
2 class hours. 1 2-hour laboratory period, credit, 3.
Professor Gage.

Prerequisite, Physiology 33 or 63.

65. III. General Physiology. — For juniors; seniors may elect. Physiology of the circulation, absorption, and excretion, with special reference to gross and microscopic anatomy. This course is especially planned for students who expect to major in subjects pertaining to plant and animal life.
2 class hours. 1 2-hour laboratory period, credit, 3.
Professor Gage.

Prerequisite, Physiology 64.

Botany.

Professor Osmun, Associate Professor Clark, Assistant Professor McLaughlin, Assistant Professor Torrey, Assistant Professor Davis.

The required courses in botany are planned to present a knowledge of the principles of plant life both for their fundamental importance in agriculture and for their general educational value. Elective courses are of two types: (1) those which have for their chief aim the direct support of technical courses in agriculture and horticulture, and (2) those providing broader, more intensive training in the science. Courses in the second group may lead to specialization in the field. They also furnish excellent training for those specializing in other sciences and in scientific agriculture. In all undergraduate courses the relation of the science of botany to agriculture is emphasized.

Required Courses.

[Courses 3 and 25 constitute a general elementary course in the botany of higher plants, and are required of all students; Course 26 is advised for all who intend to study further in the department.]

3. III. Introductory Botany. — For freshmen. Presents the seed plants as plastic organisms molded by their environment. Also introduces the student to methods of identifying and classifying plants.
2 class hours. 2 2-hour laboratory periods, credit, 4.
Laboratory fee, $1.50.
Assistant Professor Torrey and Associate Professor Clark.

25. II. Introductory Botany. — For sophomores. The anatomy and physiology of seed plants (Phanerogamia).
1 class hour. 2 2-hour laboratory periods, credit, 3.
Laboratory fee, $1.50.
Prerequisite, Botany 3.
Assistant Professor Torrey and Associate Professor Clark.

Elective Courses.

26. III. Cryptogamic Botany. — For sophomores; juniors and seniors may elect. Selected forms typifying the principal groups of lower plants are studied in the laboratory. Especial attention is given to the bacteria and fungi, and in connection with these a few representative plant diseases are studied with a view to acquainting the student with the role of these organisms as causes of disease in higher plants. The course has a two-fold purpose: (1) it is intended for students who desire to extend their knowledge to the principal branches of the plant kingdom, thus rounding out a general course of which Botany 3 and 25 constitute the first two parts; (2) the course is also planned as an introduction to the study of plant diseases by those students who expect to enter some branch of plant industry.
1 class hour. 2 2-hour laboratory periods, credit, 3.
Laboratory fee, $1.50. Professor Osmun.
Prerequisite, Botany 25.

50. **I.** 51. **II.** Diseases of Crops. — For juniors; seniors may elect. In order to permit students to specialize on the diseases of crops which are most closely related to their majors or in which they are especially interested, the course is divided for lecture and laboratory work into the following sections: (I) diseases of truck and field crops; (II) diseases of floricultural crops and ornamentals; (III) diseases of fruit crops; (IV) diseases of shade and forest trees; (V) (51 II only) the outstanding diseases of each crop group, for students majoring in entomology. Sections I–IV each consist of one lecture and one two-hour laboratory period per week and may be elected in each term in units of one, two, or three sections. Section V is offered in the second term only, consists of one conference hour and two two-hour laboratory periods per week, and may not be combined with any of sections I–IV.
1, 2, or 3 class hours. 1, 2, or 3 2-hour laboratory periods, credit, 2, 3, 4, or 6.
Laboratory fee, $2.00 per term. Assistant Professor McLaughlin.

52. **I.** 53. **II.** Systematic Mycology (1929–30). — For juniors; seniors may elect. Morphology and development of typical species representing the orders and families of fungi; practice in identification, collection, and preservation of fungi; study of systems of classification; collateral reading. A prerequisite of the senior course in plant pathology, but open to all. Given in alternate years.
1 class hour. 2 2-hour laboratory periods, credit, 3.
Laboratory fee, $2.00 per term. Assistant Professor Davis.
Prerequisite, Botany 26.

55. **III.** Plant Histology (1929–30). — For juniors; seniors may elect. Comparative study of the tissues of plants; training in histological methods, including the use of precision microtomes, methods of killing, fixing, sectioning, staining, and mounting; collateral reading and conferences. This course offers valuable training in preparation for further work in botany. Given in alternate years.
5 2-hour laboratory periods, credit, 5.
Laboratory fee, $3.00. Assistant Professors McLaughlin, Torrey, and Davis.
Prerequisites, Botany 3 and 25.

58. **I.** 59. **II.** 60. **III.** Systematic Botany of the Higher Plants (1930–31). — Alternate with Courses 61, 62, and 63. For juniors and seniors. An intensive study of gymnosperms and angiosperms. Lectures deal with the interrelations of the flowering plants and with their ecology, distribution, and economic importance. Laboratory work consists of a critical study of types from the most important natural plant families. Particular emphasis is laid on the flora of Massachusetts. The department herbarium and greenhouses supply material of important tropical forms for study.
2 class hours. 1 2-hour laboratory period, credit, 3.
Laboratory fee, $1.50 per term. Assistant Professor Torrey.

61. **I.** 62. **II.** 63. **III.** The Comparative Anatomy of Green Plants (1929–30). — Alternate with Courses 58, 59, and 60. For juniors and seniors. In the lectures an intensive study is directed to the comparative anatomy of green plants from the evolutionary standpoint. Particular emphasis is laid upon the woody forms both living and extinct. Of the latter, the department is fortunate in possessing excellent sets of micro-preparations and lantern slides.
2 class hours. 1 2-hour laboratory period, credit, 3.
Laboratory fee, $1.50 per term. Assistant Professor Torrey.
Prerequisite, Botany 26.

64. **I.** Morphology of the Vascular Plants. — For juniors; seniors may elect. Continues the work of Botany 26, but deals with the higher plants, such as ferns and fernworts, gymnosperms, and angiosperms.
2 class hours. 1 2-hour laboratory period, credit, 3.
Laboratory fee, $1.00. Assistant Professor Torrey.
Prerequisite, Botany 26.

75. I. 76. II. 77. III. Plant Pathology. — For seniors. Comprehensive study of diseases of plants; training in laboratory methods and technique, including culture work and artificial inoculation of hosts; miscellaneous diagnosis; study of literature and representative life histories of pathogens. Prepares for civil service, experiment station, and college work.
1 class hour. 4 2-hour laboratory periods, credit, 5.
Laboratory fee, $3.00 per term. Professors Osmun and Davis.
Prerequisite, Botany 26.

78. I. Plant Physiology. — For seniors. Study of the factors and conditions of (*a*) plant nutrition, including the taking up of water and mineral substances, the assimilation of carbon and nitrogen, and the release of energy due to the processes of dissimilation; (*b*) plant growth, including the influence of internal and external factors on growth, the development of reproductive and vegetative organs; (*c*) plant movements, including those due to the taking up of water, and those of both motile and fixed forms in response to external stimuli. Weekly conferences are held, at which students report on assignments to original sources in the literature.
2 class hours. 3 2-hour laboratory periods, credit, 5.
Laboratory fee, $3.00. Associate Professor Clark.
Prerequisites, Botany 26; Chemistry 51.

79A. II. 80A. III. Plant Physiology. — For seniors. As stated under Course 78.
2 class hours. 3 2-hour laboratory periods, credit, 5.
Laboratory fee, $3.00 per term. Associate Professor Clark.
Prerequisite, Botany 78.

79B. II. 80B. III. Plant Physiology. — For seniors; juniors may elect. A briefer course than Botany 78, 79A, 80A, designed especially for students in horticulture, agronomy, and floriculture, and aiming to give the underlying principles of plant physiology which will supply the scientific basis for the manifold practices in the various fields of plant culture.
2 class hours. 1 2-hour laboratory period, credit, 3.
Laboratory fee, $1.00 per term. Associate Professor Clark.
Prerequisite, Botany 25 or Chemistry 30.

81. I. Plant Ecology. — For seniors. Study of plants in relation to their environment, with special emphasis on the newer field studies, which have given increasing insight into the physical and chemical factors as they influence growth and development in the field and the adaptability of plants to changes in their normal environment. The various types of plant formations and successions are studied, as well as the mutual and antagonistic relations of certain plants.
2 class hours. 1 2-hour laboratory period, credit, 3.
Laboratory fee, $1.00. Associate Professor Clark.
Prerequisite, Botany 26.

Chemistry.

Professor Chamberlain, Professor Peters, Assistant Professor Serex, Mr. Cupery.

In teaching the courses in chemistry, emphasis is laid on both their educational and their vocational value. The courses in the freshman year deal with fundamental principles and give the student such an understanding of the subject as will enable him to appreciate the relation of chemistry to agriculture. The more advanced courses, including quantitative analysis, organic, physiological, and physical chemistry, are for those who intend to become teachers and workers in the allied sciences, or who desire to follow agricultural chemistry as a vocation. Those completing the undergraduate courses are fitted for positions in the agricultural industries — fertilizer, feed, and insecticide manufacture — as well as in other lines of industry, and in the State experiment stations, in commercial

laboratories, and in high school teaching. Postgraduate students are prepared for positions as teachers in colleges, and for more advanced positions in industry and in the experiment stations.

Required Courses.

1. **I.** 2. **II.** General Chemistry. — For freshmen who do not present chemistry for entrance and who begin the subject in college. It presents an introduction to the fundamental chemical laws, together with a study of the typical acid- and base-forming elements and their compounds. The second term contains some of the material given in Courses 4 and 5.
2 class hours. 2 2-hour laboratory periods, credit, 4.
Laboratory fee, $3.00 per term. Mr. Cupery.

4. **I.** Advanced General Chemistry. — For freshmen who present chemistry for entrance. A review of general chemistry centered, for the most part, about the laboratory work, which takes the synthetic form. Substances of agricultural importance are prepared in quantity and studied in detail by the student. These include ammonium sulfate, superphosphate, muriate and sulfate of potash, arsenate of lead, Paris green, Bordeaux mixture, lime-sulfur, and emulsions.
2 class hours. 2 2-hour laboratory periods, credit, 4.
Laboratory fee, $3.00. Professor Peters.
Prerequisite, Entrance Chemistry.

5. **II.** Inorganic Agricultural Chemistry. — A continuation of Course 4, for freshmen who present chemistry for entrance. A study of the chemical composition, properties, and reactions of soils, fertilizers, fungicides, and insecticides. The laboratory work is divided into three parts: (*a*) qualitative examination of soil, plant ash, and superphosphate; (*b*) approximate quantitative determination of moisture, ash, carbonic acid, phosphoric acid, potash, nitrogen, etc., in farm crops, soils, and fertilizers; (*c*) special work on retention of salts by soil, leaching of lime from the soil by carbonated water, etc.
2 class hours. 2 2-hour laboratory periods, credit, 4.
Laboratory fee, $3.00. Assistant Professor Serex.
Prerequisite, Chemistry 4.

Elective Courses.

25. **II.** Qualitative Analysis. — *Basic.* — For sophomores. The systematic analysis of metallic salts, presented from the ionic viewpoint. A close study of the tests used in the separation and identification of the metals, and the application of these tests to unknown mixtures. This course should be taken by all intending to follow chemistry as a vocation.
1 class hour. 2 2-hour laboratory periods, credit, 3.
Laboratory fee, $4.00. Assistant Professor Serex.
Prerequisite, Chemistry 2 or 5.

26. **III.** Qualitative Analysis. — *Acidic.* — For sophomores. A continuation of Course 25.
1 class hour. 2 2-hour laboratory periods, credit, 3.
Laboratory fee, $4.00. Assistant Professor Serex.

30. **II.** Organic Agricultural Chemistry. — For sophomores; juniors and seniors may elect. Embraces the study of the most important groups of organic compounds of plants and animals, the composition of plants, the chemistry of plant growth, plants as food and as industrial material, the composition of animals, the chemistry of digestion, also the study of some of the products related to plants and animals, such as milk, butter, cheese, sugar, and alcohol. The treatment of the subject is general, avoiding (so far as possible) complicated chemical facts and relationships, and endeavoring simply to make the student acquainted with the general chemistry of plants and animals and agricultural processes and products.
3 class hours. Credit, 3.
Professor Chamberlain.

51. I. 52. II. 53. III. Organic Chemistry. — For juniors; seniors may elect. A systematic study, both from texts and in the laboratory, of the more important compounds in the entire field of organic chemistry. Especial attention is given to those compounds which are found in agricultural products or are manufactured from them. These include alcohols, acids, esters, fats, carbohydrates, and proteins. In the third term compounds in the benzene series are considered. The work forms a foundation for courses in physiological chemistry and agricultural analysis, and is especially planned for those majoring in chemistry or the other sciences.
3 class hours. 2 3-hour laboratory periods, credit, 6.
Laboratory fee, $5.00 per term. Professor Chamberlain.
Prerequisite, Chemistry 2 or 5. Chemistry 26 is prerequisite for those majoring in chemistry.

61. I. Quantitative Analysis. — For juniors; seniors may elect. The course includes the gravimetric determination of chlorides, sulfates, iron; the volumetric analysis of acids and bases; and the dichromate method for iron.
1 class hour. 2 4-hour laboratory periods, credit, 5.
Laboratory fee, $5.00. Professor Peters.
Prerequisite, Chemistry 25. Chemistry 26 is prerequisite for those majoring in chemistry.

62. II. For juniors; seniors may elect. A continuation of Course 61. A study of potassium permanganate as a volumetric reagent; limestone is analyzed; phosphorus is determined in soil; and the perchlorate method for potash is carried out. Analytical problems are a part of the work.
2 class hours. 2 4-hour laboratory periods, credit, 6.
Laboratory fee, $5.00. Professor Peters.

63. III. For juniors; seniors may elect. A continuation of Course 62. A study of the oxidation reactions of iodin and the precipitating reactions of thiocyanate; the analysis of Paris green and lead arsenate. The work closes with water analysis. By means of assigned readings, students are shown the importance of library work.
1 class hour. 2 4-hour laboratory periods, credit, 5.
Laboratory fee, $5.00. Professor Peters.

75. I. Physical Chemistry. — For seniors. A study of the fundamental theories and laws of physical chemistry, together with laboratory work which includes the important methods of physicochemical measurements.
3 class hours. 6 laboratory hours, credit, 6.
Laboratory fee, $5.00. Assistant Professor Serex.
Prerequisite, Chemistry 61.

80. I. Physiological Chemistry. — For seniors. Supplementary to Courses 51, 52, and 53. For those who expect to take up scientific work in microbiology, botany, agronomy, animal husbandry, etc., and who have had Courses 51, 52, and 53, it gives acquaintance with the chemistry of the physiological processes in plants and animals, by means of which some of the important organic compounds studied in Courses 51, 52, and 53 are built up in the living organism or are used as food by it. In the lectures, the study of food and nutrition as related to both human and domestic animals is the principal subject. In the laboratory, experimental studies are made of the animal body and of the processes and products of digestion, secretion, and excretion.
3 class hours. 2 2-hour laboratory periods, credit, 5.
Laboratory fee, $4.00. Mr. Cupery.

81. II. Food Analysis. — For seniors. Primarily the analytical study of milk and butter. May also include the analysis of other food stuffs for nutritive value or for impurities.
1 class hour. 2 4-hour laboratory periods, credit, 5.
Laboratory fee, $5.00. Mr. Cupery.
Prerequisite, Chemistry 61.

86. **II.** Review of General Chemistry. — For seniors. Primarily for students majoring in chemistry; others may elect by permission of the instructor. A knowledge of physical chemistry is desirable. The review of general chemistry is largely theoretical. Some subjects may be enlarged by special lectures, such as atomic structure, Werner's co-ordination theory, crystal structure as shown by X-rays.
3 class hours. Credit, 3.
Professor Peters.

87. **III.** History of Chemistry. — For seniors. An historical and biographical study of chemistry and chemists. The aim of the course is: (1) to give the student a comprehensive view of the science as a whole, through a study of the development of new ideas and the establishment of new theories and laws; and (2) to arouse an enthusiastic interest in the subject and an appreciation of the true spirit of scientific research, through a sympathetic presentation of the work and lives of the great chemists who have been the creators of the chemistry of today. The course will consist of lectures, supplemented by systematic correlated reading and the preparation of reports or essays.
3 class hours. Credit, 3.
Professor Chamberlain.

90. **II.** 91. **III.** Special Work in Chemical Problems. — For seniors. An assignment is made to each student, and he is expected to learn how research is done. The problem may be in analytical, general, agricultural, or industrial chemistry, and is to be continued for two terms.
1 class hour. 8 laboratory hours, credit, 5.
Laboratory fee, $5.00 per term. Professor Peters.

92. **II.** 93. **III.** Special Work in Organic Chemistry. — For seniors. In this course, as in Courses 90 to 97, the student may give his attention primarily to one line of chemical study for the purpose of becoming acquainted with methods of research. To those whose tastes and interests are in connection with the organic problems of agricultural chemistry, many subjects of study present themselves, among which may be mentioned: proteins, carbohydrates, fats; organic nitrogenous compounds in fertilizers and soils, and their relation to plants; the commercial production of alcohol from agricultural products; dyes, synthetic medicines, perfumes, etc.
1 class hour. 8 laboratory hours, credit, 5.
Laboratory fee, $5.00 per term. Professor Chamberlain.
Prerequisites, Chemistry 51, 52, 53, and 80.

94. **II.** 95. **III.** Special Work in Physical Chemistry. — For seniors. The field of agricultural chemistry offers many problems that have been attacked through the methods of physical chemistry; such, for example, are the hydrolysis of salts and of minerals and the absorption of salts and fertilizers by soils. This course is designed to familiarize the student with the literature on a special topic, and to give an insight into the methods of research. Each student selects one line of work and follows it through the course, repeating some of the original work. Students interested in colloid chemistry may make a brief study of fundamentals during the first term of this course, with the ultimate object of selecting a problem along this line for the second term.
1 class hour. 8 laboratory hours, credit, 5.
Laboratory fee, $5.00 per term. Assistant Professor Serex.
Prerequisite, Chemistry 75.

96. **II.** 97. **III.** Special Work in Physiological and Food Chemistry. — For seniors. An opportunity for those so interested to pursue the study of some physiological or food problem. This course is intended to familiarize the student with the nature of research under the careful supervision of the in-

structor. The problems of physiological chemistry are of a varied and interesting character.

1 class hour. 8 laboratory hours, credit, 5.
Laboratory fee, $5.00. Mr. Cupery.
Prerequisite, Chemistry 80.

Entomology.

Professor Fernald, Professor Crampton, Assistant Professor Alexander, Mr. Farrar, Mr. Salman.

Courses in entomology are for two purposes: (1) The introductory courses aim to give the students a general knowledge of insects, particularly in their relations to man, his crops, his domestic animals, and his health. (2) Later courses are intended to train students desiring to specialize in entomology to become United States, State, or experiment station entomologists, teachers, foresters, tree wardens, entomologists connected with insecticide-manufacturing companies, consulting entomologists, or to occupy other positions where an expert knowledge of insects is called for. The beekeeping courses are offered with the following aims: (1) To meet the increase in vocational opportunities for the production of bees or honey as a business. (2) To study the beekeeping needs of fruit and truck-crop industries and the part that bees play in pollinating flowers. (3) To acquaint the student with a recreational field of many phases, which can be made profitable.

Elective Courses.

26. **I.** General and Economic Entomology. — Primarily for sophomores intending to major in one of the biological sciences; other sophomores, juniors, and seniors may elect. For students who desire some knowledge of insects but who cannot give more than one term to the subject; also an introduction to the later courses for those who intend to follow entomology further. Touches briefly upon the structure of insects, so far as this is needed for such a course; deals with metamorphosis and classification to the larger groups, and discusses the most important methods and materials used for control. The greater part of the time is devoted to special study of the most important insect pests, particularly of New England, showing their modes of life, the injuries they cause, and the best methods of control. In this way the most serious pests of fruit trees, ornamental trees and shrubs, market-garden and green-house crops, field crops, animals, and man are treated.

3 class hours. Credit, 3.
Professor Fernald.

28. **III.** Field Studies in Entomology. — For sophomores intending to major in one of the biological sciences; other sophomores, juniors, and seniors admitted by permission of instructor in charge. Three class-room exercises to about May 1; thereafter three field exercises per week. In the field the work of insects found will be studied and a collection of insects made. Methods of collecting, preparing, and mounting insects for collections will be taught. In the class room, until about May 1, studies preparatory to the field work will be given. Class limited.

3 class hours to about May 1; thereafter, 3 2-hour laboratory periods, credit, 3.
The Department.
Prerequisite, Entomology 26.

50. **I.** Pests of Special Crops. — For juniors and seniors not majoring in entomology. The laboratory work is largely individual in this course. Students majoring in subjects other than entomology, who desire a more complete knowledge of the insects connected with their major lines of work, can obtain it through this course. Work consisting of a careful study of the important economic insect pests leads to an ability to recognize their different stages, and their work, and to a knowledge of the best methods for their control. Work of this kind is available on the insects attacking field crops, market-garden crops, tree fruits, small fruits, shade trees and shrubs, forest trees, flowers, the domestic

animals, household articles, and man. This course can also be begun or continued in the winter term as Course 51.

3 2-hour laboratory periods, credit, 3.
Laboratory fee, $1.00. Mr. Salman.
Prerequisite, Entomology 26.

51. **II.** Pests of Special Crops. — For juniors; seniors may elect. Individual laboratory work in the more important insect pests in this country and the preparation and presentation of bulletin material on them.

3 2-hour laboratory periods, credit, 3.
Laboratory fee, $1.00. Mr. Salman.
Prerequisite, Entomology 26.

52. **I.** Classification of Insects. — For juniors specializing in entomology. Laboratory work on the identification and classification of insects of various groups.

2 2-hour laboratory periods, credit, 2.
Laboratory fee, $1.00. Assistant Professor Alexander.
Accompanying Entomology 53.

53. **I.** Insect Morphology. — For juniors specializing in entomology, and for other juniors or seniors having the prerequisite. The lectures treat of the external and internal anatomy of insects, particularly those parts used in identification, a knowledge of which is needed in the accompanying Course 52. In the laboratory the external anatomy of the most important groups is studied, with emphasis on the characters used in learning the names of insects, and on the methods of using analytical keys.

2 class hours. 3 2-hour laboratory periods, credit, 5.
Laboratory fee, $1.00. Professor Crampton.
Prerequisite, Entomology 26.

55. **II.** Classification of Insects. — Continuation of Course 52. A part of the time is devoted to a study of insects concerned in conveying diseases of man and other animals.

4 2-hour laboratory periods, credit, 4.
Laboratory fee, $1.00. Professors Crampton and Alexander.

57. **III.** Classification of Insects. — Continuation of Course 55.

2 2-hour laboratory periods, credit, 2.
Laboratory fee, $1.00. Assistant Professor Alexander.

75. **III.** Forest and Shade-tree Insects. — For juniors; seniors may elect. The lecture work deals with the principles and methods of controlling insects which attack forests and forest products, shade trees, etc. The laboratory periods are devoted to a study of the more important species, their identification, biology, and specific control measures. Field work supplements laboratory study if time permits. One entire Saturday for field excursion is also required.

1 class hour. 3 2-hour laboratory or field periods, credit, 4.
Laboratory fee, $2.00. Assistant Professor Alexander.
Prequisite, Entomology 26; 52 and 53 desirable.

76. **I.** Advanced Entomology. — For seniors. Studies of arthropods other than insects, with particular reference to their economic importance; the internal anatomy of insects; scale insects, their structure, habits, methods of mounting, identification, etc.

2 class hours. 3 2-hour laboratory periods, credit, 5.
Laboratory fee, $3.00. Professors Crampton and Alexander.
Prerequisite, Entomology 55.

77. **II.** Advanced Entomology. — For seniors. Studies of the life history, habits, and methods of control of the important insect pests of the United

States; recognition tests of these pests, and an examination of the literature on them; methods of bulletin preparation.

3 2-hour laboratory periods, credit, 3.
Laboratory fee, $1.00. Assistant Professor ALEXANDER.
Prerequisite, Entomology 76.

78. **III.** ADVANCED ENTOMOLOGY. — For seniors. Classification of insects and of their early stages; principles of classification, the use of literature on entomology, and the preparation of bibliographies and indices; the enemies of insects.

1 class hour. 3 2-hour laboratory or field periods, credit, 4.
Laboratory fee, $2.00. Professors FERNALD, CRAMPTON, and ALEXANDER.
Prerequisite, Entomology 77.

79. **I.** INSECTICIDES AND THEIR APPLICATION. — For seniors; juniors may elect. Lectures on the composition, preparation, and methods of application of insecticides; other control measures.

3 class hours. Credit, 3.
Professor FERNALD.

Prerequisite, Entomology 26.

80. **I.** INSECT ECOLOGY. — For seniors. The relation of the insect to its environment, covering the topics: definitions, present status of the subject, factors of environment such as temperature, moisture, light, etc., and their effect; the biotic potential; environmental resistance; ecological succession; aquatic and terrestrial insect communities; applied ecology.

3 class hours. Credit, 3.
Mr. SALMAN.

Prerequisite, Entomology 57.

81. **II.** BIOLOGICAL CONTROL. — For seniors. The topics treated in this course include types of parasitic organisms; insect diseases; other organisms as parasites of insects; insect parasites; predators; the natural ecological status of insect parasitism and the economic status of parasites.

3 class hours. Credit, 3.
Mr. SALMAN.

Prerequisite, Entomology 80.

82. **III.** INSECTARY PRACTICE. — For seniors majoring in entomology. In the class exercises, consideration is given to the methods, practices, and apparatus used in life history studies. The laboratory exercises illustrate the uses and applications of the above through the medium of simple life history problems.

1 class hour. 3 2-hour laboratory periods, credit, 4.
Mr. SALMAN.

Prerequisite, Entomology 81.

90. **II.** EVOLUTION. — For seniors; juniors may elect. In order to demonstrate the universal scope and operation of the laws of evolution, the course includes a brief sketch of the probable origin and evolution of matter as viewed in the light of modern physical and chemical research; the evolution of the solar system, leading to the formation of the earth; the changes in the earth, preparatory to the production of life; the physical and chemical basis of life; the probable steps in the formation of living matter, and the theories concerning it; the evolution of living things; the developmental history of man, and of the races of mankind; the evolution of human intelligence, languages, culture, institutions, etc., and man's probable future in the light of his past development. Especial consideration is given to the factors of evolution, the basic principles of heredity, variation, and similar topics, with particular reference to their application to human welfare; and the recent contributions in the field of entomology to the advancement of our knowledge of these fundamental principles are briefly reviewed.

3 class hours. Credit, 3.
Professor CRAMPTON.

Beekeeping.

Elective Courses.

65. **III.** Introductory Beekeeping. — For juniors; seniors may elect. A detailed study is made of the bee colony, including its organization, the life of its individuals in relation to the colony, and the cycle of the year. Attention is given to practical methods of managing colonies during the spring and early summer. Spring pollen, nectar flora, and the horticulturist's use and need of bees are other phases of the work covered. The laboratory work provides a study of beekeeping equipment; individual manipulation and an understanding of colony development is afforded. During the first half of the term a lecture is substituted for one of the laboratory periods. To be complete, this course should be followed by Course 85.

1 class hour. 2 2-hour laboratory periods, credit, 3.

Mr. Farrar.

85. **I.** Introductory Beekeeping. — For seniors. The work begun in Course 65 is continued for the completion of the beekeeping year, including late summer and fall management, wintering, and care and marketing of the crop. A more detailed study is made of regional differences, methods, and requirements for different types of honey production.

2 class hours. 1 2-hour laboratory period, credit, 3.

Mr. Farrar.

Prerequisite, Entomology 65.

86. **II.** Advanced Beekeeping. — For seniors. Advanced studies are made of important beekeeping problems, including anatomy and physiology; senses and bee behavior; soil and climatic factors influencing nectar secretion; kinds, importance, and distribution of pollen and nectar sources; bee disease control; marketing problems; queen rearing and commercial bee production. Parts of this work are made individual, depending on the needs of the student.

2 class hours. 1 2-hour laboratory period, credit, 3.

Mr. Farrar.

Prerequisite, Entomology 85.

Mathematics and Civil Engineering.

Professor Ostrander, Professor Machmer, Assistant Professor Moore, Mr. Boutelle.

The work of the freshman year is required. It is intended to furnish the necessary drill and groundwork needed for many of the scientific and practical courses of other departments. Thoroughness and accuracy are insisted upon. The advanced work in mathematics is taught from a practical standpoint, and many of its applications to other subjects are given. The courses in surveying and civil engineering are given to furnish the groundwork for a professional career. Special emphasis is given to the subjects bearing on highway construction and maintenance.

Required Courses.

1. **I.** Higher Algebra. — For freshmen. A brief review of radicals, quadratic equations, ratio and proportion, and progressions; graphs, binomial theorem, summation of series, variation, determinants, permutations and combinations, logarithms, and theory of equations.

3 class hours. Credit, 3.

Professors Machmer, Moore, and Mr. Boutelle.

2. **II.** Plane Trigonometry. — For freshmen. The trigonometric functions as lines and ratios; proofs of the principal formulas, transformations; inverse functions, use of logarithms; the applications to the solution of right and oblique triangles; practical applications; trigonometric equations.

3 class hours. Credit, 3.

Professors Machmer, Moore, and Mr. Boutelle.

3. **III.** Mathematical Analysis. — For freshmen. A review of methods of computation, with special emphasis on short processes and the making of close approximations. A study of some of the different modes of variation; finding the exact or approximate relations (equations) between the varying quantities, particularly as illustrated by the use of the graph. Also a study of the properties of closed figures, such as polyhedra, cylinders, cones, and the sphere, and calculations of their surfaces and volumes. An effort is made to apply mathematical processes directly to the work given in the various technical departments of the college.
3 class hours. Credit, 3.
Professors Machmer, Moore, and Mr. Boutelle.

Elective Courses.

26. **II.** Plane Surveying. — For sophomores; juniors and seniors may elect. The elements of the subject, including the adjustment and use of the usual instruments. Textbook and lectures.
3 class hours. Credit, 3.
Professors Ostrander and Moore.

27. **III.** Plane Surveying. — For sophomores; juniors and seniors may elect. As stated under Course 26. Includes field work.
3 2-hour laboratory periods, credit, 3.
Laboratory fee, $1.50. Professors Ostrander and Moore.
Prerequisite, Mathematics 26.

50. **I.** Analytical Geometry. — For juniors; seniors may elect. A discussion of the geometry of the line, the circle, conic sections, and the higher plane curves.
3 class hours. Credit, 3.
Professor Machmer.
Prerequisites, Mathematics 1, 2, and 3.

51. **II.** 52. **III.** Differential and Integral Calculus. — For juniors; seniors may elect. A first course in the subject, with some of the more important applications to applied sciences.
5 class hours. Credit, 5.
Assistant Professor Moore.
Prerequisites, Mathematics 1, 2, and 3.

53. **II.** Elementary Structures. — For juniors; seniors may elect. An elementary course in roofs and bridges. Textbook and lectures.
3 class hours. 1 2-hour laboratory period, credit, 4.
Professor Ostrander.

75. **I.** Hydraulics and Sanitary Engineering. — For seniors; juniors may elect. Hydrostatics, theoretical hydraulics, orifices, weirs, pipes, conduits, water supply, hydraulic motors, sewers and sewage treatment. Textbook and lectures.
5 class hours. Credit, 5.
Professor Ostrander.

76. **I.** Materials of Construction. Foundations and Masonry Construction. — For seniors; juniors may elect. Textbook and lectures.
5 class hours. Credit, 5.
Professor Ostrander.

77. **II.** Roads and Railroads. — For seniors; juniors may elect. Topographic and higher surveying, highway construction, earthwork, pavements, and railroad construction. Textbook and lectures.
3 class hours. Credit, 3.
Professor Ostrander.

78. **III.** Roads and Railroads. — For seniors; juniors may elect. As stated under Course 77.

3 2-hour laboratory periods, credit, 3.
Laboratory fee, $1.50. Professor Ostrander.
Prerequisite, Mathematics 77.

Physics.

Professor Powers, Assistant Professor Alderman.

The courses in this department present a basic study of the physical laws and phenomena of nature with special emphasis on the applications of the principles studied. These courses furnish satisfactory training for pre-medical students and for prospective teachers in secondary schools. Courses 25, 26, and 27 constitute a study in general physics. The other courses afford opportunity for more advanced and individual work.

Elective Courses.

25. **I.** Mechanics. — For sophomores; juniors and seniors may elect. This course is largely a study of the following and related topics: equilibrium of bodies; forms of energy and work; types of motion; fluids; surface tension; molecular phenomena; elasticity; wave-motion.
2 class hours. 1 2-hour laboratory period, credit, 3.
Laboratory fee, $2.00. The Department.

26. **II.** Magnetism and Electricity. — For sophomores; juniors and seniors may elect. Includes magnetism, electrostatics, production and properties of electric currents, electrical appliances and machines, oscillatory circuits, vacuum tubes, and related topics.
2 class hours. 1 2-hour laboratory period, credit, 3.
Laboratory fee, $2.00. The Department.

27. **III.** Heat and Light. — For sophomores; juniors and seniors may elect. Thermometry, expansion, hygrometry, transmission of heat, changes of state, radiation; wave theory of light, optical instruments, analysis of light, interference, polarization; allied subjects.
2 class hours. 1 2-hour laboratory period, credit, 3.
Laboratory fee, $2.00. The Department.

50. **I.** 51. **II.** 52. **III.** Magnetism, Electricity, Photo-electricity, Thermionics, and Applications. — For juniors and seniors. Course 50 deals largely with direct currents, Course 51 with alternating currents, and Course 52 with applications of thermionics and photo-electricity. These courses are planned to give the student a good grounding in theory and methods of measurement in the subjects indicated, which are useful in many fields of investigation. Modern methods are stressed and instruments of precision are used.
2 class hours. 1 2-hour laboratory period, credit, 3.
Laboratory fee, $2.00 per term. Professor Powers.
Prerequisites, Physics 26 for Courses 50 and 51; Physics 51 for Course 52.

54. **II.** Thermodynamics. — For juniors; seniors may elect. A study of energy changes due to heat in systems of matter. The subject material and experimental methods are useful in other branches of science.
2 class hours. 1 2-hour laboratory period, credit, 3.
Laboratory fee, $2.00. Assistant Professor Alderman.
Prerequisite, Physics 27.

55. **III.** Optics. — For juniors; seniors may elect. An intermediate course in the theory of light. Work in geometrical and physical optics is done. Precision instruments are used in the laboratory.
2 class hours. 1 2-hour laboratory period, credit, 3.
Laboratory fee, $2.00. Assistant Professor Alderman.
Prerequisite, Physics 27.

75. I. 76. II. 77. III. Advanced Experimental Work in Selected Topics. — For seniors. These courses are largely experimental, and the subject matter is adapted to the needs of the individual student. The research viewpoint is emphasized.

3 2-hour laboratory periods, credit, 3.

Laboratory fee, $2.00 per term. Professor Powers.

Prerequisites, Physics 25, 26, 27, 50, 51, and 52; Mathematics 51 and 52.

Veterinary Science.

Professor Lentz.

The courses in veterinary science have been arranged to meet the needs (1) of students who propose following practical agriculture; (2) of prospective students of human and veterinary medicine; and (3) of teachers and workers in the biological sciences.

Elective Courses.

50. II. Veterinary Hygiene. — For juniors; seniors may elect. Acquaints students with the influences which air, water, feed, light, disposal of animal waste material, etc., may have upon the health of animals and upon the health of those who use both animals and animal products.

5 class hours. Credit, 5.

Professor Lentz.

75. I. Comparative Veterinary Anatomy. — For seniors; juniors may elect. The structure of the horse is studied and the structure of the other farm animals compared with it. This is a lecture and demonstrational course — not dissection — and is essential for students who wish to elect Veterinary 77.

5 class hours. Credit, 5.

Professor Lentz.

76. II. General Veterinary Pathology. — For seniors; juniors may elect. A study of fundamental, general pathological conditions; inflammation, fever, hypertrophy, atrophy, etc., a knowledge of which is essential in the prevention, diagnosis, and treatment of disease. Materia medica, therapeutic measures, and poisonous plants are considered briefly.

5 class hours. Credit, 5.

Professor Lentz.

77. III. Applied General Veterinary Pathology. — For seniors; juniors may elect. A continuation of Course 76, with specific application of principles to etiology, pathogenesis, and prophylaxis of communicable and non-communicable diseases of domesticated animals.

5 class hours. Credit, 5.

Professor Lentz.

Prerequisite, Veterinary 75.

89. II. Avian Pathology. — For seniors; juniors may elect. This is a lecture course devoted to principles of pathology, with specific application to avian diseases. Etiology, pathogenesis, and prophylaxis will be emphasized. Offered for the year 1929–30.

3 class hours. Credit, 3.

Professor Lentz.

Prerequisites, Bacteriology 50 and 51; Physiology 63, 64, and 65.

Zoology and Geology.

Professor Gordon, Mr. Gilbert.

The undergraduate courses as listed are essentially introductory in character and lay stress on basic principles. Students majoring in biological science, and others properly qualified, may arrange for supplementary studies of a more advanced or special nature.

Zoology.

Elective Courses.

26. **I.** Elements of Zoology. — For sophomores; juniors and seniors may elect. This course is a general one and provides a measure of preparation for such subsequent studies as assume some acquaintance with the phenomena of animal life.
2 class hours. 1 2-hour laboratory period, credit, 3.
Laboratory fee, $2.00. The Department.

50. **II.** Elements of Microscopic Technique. — For juniors; seniors and graduate students may elect. Open to students upon consultation with the department. The course consists of a series of practical exercises in preparing animal tissues for microscopic examination, and a study of principles and methods involved in such work.
3 2-hour laboratory periods, credit, 3.
Laboratory fee, $5.00. The Department.
Prerequisite, Zoology 26.

65. **I.** 66. **II.** 67. **III.** Comparative Invertebrate Zoology, or Comparative Vertebrate Zoology. — For juniors, seniors, and graduate students. Students are admitted to these courses only upon consultation with the department. The work in both subjects is arranged to run through the year and comes at the same scheduled hours in each term; but the courses are separate, and, if both are desired, must be taken in alternate years. The spring term work in the zoology of the vertebrates, 67. III., deals with mammalian anatomy (based) on the cat), and the students who have not had vertebrate zoology, 65. I. and 66. II., may, upon consultation with the department, arrange to take vertebrate zoology, 67. III. The spring term work in invertebrate zoology, 67. III., deals chiefly with the arthropods, and students who have not had invertebrate zoology, 65. I. and 66. II., may, upon consultation with the department, arrange to take invertebrate zoology, 67. III.
1 class hour. 2 2-hour laboratory periods, credit, 3.
The Department.
Laboratory fee, $3.00 per term for those who pursue either course through the year; for those taking spring term only, the laboratory fee is $4.50.
Prerequisite, Zoology 26.

75. **I.** 76. **II.** 77. **III.** Embryology. — For juniors, seniors and graduate students. Students are admitted to these courses only upon consultation with the department. The work in each term is more or less distinct, as explained below. Course 75. I. deals with the basic principles of development, heredity, and sex in animals, and is open to students who have had Zoology 26. Course 76. II. treats of the early stages of development of the chick, and is open to students who have previously taken or are pursuing work in comparative vertebrate zoology, and to qualified students who wish an introduction to the development of the chick in connection with their work in other departments. Course 77. III. deals with the development of the mammal and is open to students who have previously taken or are pursuing work in comparative vertebrate zoology and who have had Course 76. II. Not given 1929–30.
1 class hour. 2 2-hour laboratory periods, credit, 3.
Laboratory fee, winter and spring terms only, $3.00 per term.
The Department.
Prerequisites, as stated above.

79. **III.** Ornithology. — For juniors; seniors and others may elect. The taxonomic characters, relationships, adaptive radiation, migrations, distribution, and habits of birds. Lectures, practical exercises in the museum, and studies in the field.
1 class hour. 2 2-hour laboratory periods, credit, 3.
Laboratory fee, $2.00. Professor Gordon.

85. I. 86. II. 87. III. Special Problems. — For seniors and graduate students. Seniors who are pursuing a major in biology, and graduate students who wish to take a minor in the department, may arrange for special work. Credit, 3.

Laboratory fee, $3.00 per term. Professor Gordon.

Geology.

Elective Courses.

Each of the courses named below is distinct, so that a student may elect only one, or any two, or all three, in any sequence. For those who wish a year's work in geology, the desirable sequence is in the order given.

50. I. Elements of Petrology. — For juniors, seniors, and graduate students. This course deals with the rock-forming minerals and the various kinds of rocks, by means of lectures and laboratory studies, with discussions of the processes by which rocks are formed, and their modes of occurrence and structural features.

1 class hour. 2 2-hour laboratory periods, credit, 3.
Professor Gordon.

51. II. Dynamic and Physiographic Geology. — For juniors, seniors, and graduate students. A study of the work of the various agents that shape the surfaces of the lands. The history of the development of land forms.

1 class hour. 2 2-hour laboratory periods, credit, 3.
Professor Gordon.

52. III. Historical Geology. — For juniors, seniors, and graduate students. A review of the more important events in the physical history of North America, and of the plants and animals of the past.

1 class hour. 2 2-hour laboratory periods, credit, 3.
Professor Gordon.

DIVISION OF SOCIAL SCIENCES.

Professor Mackimmie.

Agricultural Economics.

Professor Cance, Professor Lindsey, Assistant Professor Jefferson, Mr. Smart, Mr. Bell.

Instruction in agricultural economics is designed to show that the agricultural industry justifies its existence chiefly as a supplier of food and raw textile materials for human consumption; that agricultural success is measured by production of values as well as by production of volume of agricultural products; that the goal of the farmer is the largest net profit over a long-time period; that agricultural production includes all processes from purchase of seed and fertilizer and preparation of seedbed until the product reaches the consumer, including collection, transportation, storage, financing, packing, handling, and selling; that a knowledge of the business of agriculture and agricultural commerce is today more necessary than a knowledge of agricultural technique. The work of this department is conducted by means of lectures, readings, and research in both library and field.

Required Course.

26. II. Agriculture and Industry. — For sophomores. A course in applied economics. This course should acquaint the student with the variety and magnitude of the agricultural, manufacturing, and other allied industries, their geographic location, economic characteristics, the physical and social reasons for their location and character, their functions, their inter-relations, and their importance in our modern economic life.

3 class hours. Credit, 3.
Professor Cance and Mr. Bell.

Elective Courses.

50. **I.** Elements of Agricultural Economics. — For juniors; seniors may elect. This course is designed to follow the course in elements of economics. It deals with the economic principles underlying the welfare and prosperity of the farmer and with those institutions upon which his economic success depends; the economic elements in the production and distribution of agricultural wealth; means of exchange; problems of land tenure and land values; taxation of farm property; and the maintenance of the economic status of the farmer. Lectures, text, readings, topics, and field work.

Professor Cance.

5 class hours. Credit, 5.

51. **III.** The Evolution of Agriculture. — For juniors; seniors may elect. A general survey of the evolution of the agricultural industry. Significant developments are traced and their causes and consequences studied. An attempt is made to give the student a knowledge of the changes which have taken place and which are taking place in the agricultural industry, the conditions which accompany these changes, and to furnish a basis by which the significance and the course of present and future developments in agriculture may be judged. Special emphasis will be placed on the development of agriculture in New England and the United States. Lectures, readings, and library work.

5 class hours. Credit, 5.

Mr. Bell.

52. **II.** Co-operation in Agriculture. — For juniors; seniors may elect. The history, principles, and business relations of agricultural co-operation. (1) A survey of the development, methods, and economic results of farmers' organizations and great co-operative movements; (2) the business organization of agriculture abroad, and the present aspects and tendencies in the United States; (3) the principles underlying successful co-operative endeavor among farmers, and practical working plans for co-operative associations, with particular reference to purchase of supplies and the marketing of perishable products. Lectures, text, assigned readings, and practical exercises.

5 class hours. Credit, 5.

Professor Cance.

53. **III.** The Agricultural Market. — For juniors; seniors and graduate students may elect. A study of the forces and conditions which determine the prices of farm products and the mechanism, methods, and problems concerned with transporting, storing, and distributing them. Supply and demand, course of prices, terminal facilities, the middleman system, speculation in agricultural products, protective legislation, the retail market, and direct sales are taken up. The characteristics and possibilities of the New England market are given special attention. Lectures, readings, assigned studies, and field work. Class trip to Boston or Springfield for market inspection, at an estimated expense of five to ten dollars.

5 class hours. Credit, 5.

Professor Cance.

54. **I.** Economics of Consumption. — For juniors; seniors and graduate students may elect. The purpose of this course is a consideration of the importance of consumption in modern industry and commerce. It includes a study of the laws of consumption, standards of living, sources and factors determining family incomes, and of the administration of these incomes as shown by the expenditures of the nation and of various groups. The relation of consumption to the problems of population and to the development of society is also studied. Lectures, assigned readings, and class discussions.

3 class hours. Credit, 3.

Assistant Professor Jefferson.

75. **II.** Rural and Business Law. — For seniors; juniors may elect. Land, titles, public roads, rights incident to ownership of live stock, contracts, com-

mercial paper, and distinctions between personal and real property. Text, written exercises, lectures, and class discussions.
5 class hours. Credit, 5.
Mr. Smart.

76. II. Principles of Transportation. — For seniors and graduate students; juniors may elect. The development of highway, waterway, and railway transportation, and its relation to the agricultural and industrial development of the country; the principles governing the operation and control of transportation agencies; present-day problems relating to the shipment of farm products, rates, facilities, and services; methods of reducing wastes in transportation; the economics of the good roads movement and of motor transportation. Lectures, text, and field work.
5 class hours. Credit, 5.
Professor Cance.

77. I. Problems in Agricultural Economics. — For seniors and graduate students; juniors may elect. An advanced course for those desirous of studying more intensively some current economic problems. Studies in economic philosophy and the economic aspects and consequences of progress in the physical and biological sciences, current economic questions, agricultural legislation, and government aids and subsidies are some of the problems discussed. Particular attention will be given to economic problems relating to New England. Students will be encouraged to pursue lines of individual interest.
5 class hours. Credit, 5.
Professor Cance.

78. III. Agricultural Credit and Finance. — For seniors; juniors may elect. The use of credit in the production and marketing of agricultural products; the development, organization, and methods of operation of credit institutions. Methods of improving individual credit and increasing present credit facilities.
3 class hours. Credit, 3.
Professor Lindsey.

79. I. Principles and Methods of Statistics. — For seniors and graduate students; juniors may elect. Methods of collecting, analyzing, interpreting, and presenting statistical information. The application of statistical methods to the fields of agriculture, economics, education, business, and industry is emphasized through practical laboratory problems.
2 class hours. 3 2-hour laboratory periods, credit, 5.
Professor Lindsey.

80. I. 81. II. 82. III. Seminar. — For seniors and graduate students. Research in agricultural economics and history; problems of New England agriculture. Library work and reports. If desirable some other topic may be substituted.
1 or 2 2-hour conference periods, credit, 1 or 2.
The Department.

83. I. Economics of Salesmanship. — For seniors; juniors may elect. The course embraces a study of the principles and practices that are involved in the selling of goods and services. The application of these principles of salesmanship to the disposal of agricultural products is especially emphasized. Types of sales, motives for buying, securing interviews, types of prospects, preparation of sales talks, meeting objections and excuses, and sales demonstrations by students and the instructor are included.
2 class hours. Credit, 2.
Mr. Bell.

84. III. Advertising Agricultural Products. — For seniors; juniors may elect. A course dealing with the application of the principles of advertising to

agricultural products. A study of the nature of advertising, the economics of advertising, the use of media, copy, psychology as applied to advertising layout, the advertising campaign, advertising agency, etc., is made. The solution of practical problems to emphasize different phases of advertising is required of students.

2 class hours. Credit, 2.

Mr. Bell.

85. II. Advanced Statistics. — For seniors and graduate students. The use of statistics in the analysis of economic data, with special emphasis on prices; the use of multiple correlation methods in price analysis.

3 2-hour laboratory periods, credit, 3.

Professor Lindsey.

Prerequisite, Agricultural Economics 79.

86. III. Agricultural Prices. — For seniors and graduate students. A study of prices of agricultural products and of other commodities of importance to agriculture.

2 or 3 2-hour laboratory periods, credit, 2 or 3.

Professor Lindsey.

Prerequisite, Agricultural Economics 79.

87. III. Foreign Trade in Agricultural Products. — For seniors and graduates; juniors may elect. A general course embracing a study of the principles and practices of international trade and the foreign commerce of the United States, particularly with reference to agricultural products. The development and present status of foreign trade in agricultural products, trade relations with foreign nations, the agencies and practices of foreign trade, foreign-trade salesmanship and advertising, the status of New England with reference to foreign trade are some of the topics which will be presented. The work in the course will also include a personal study of special features of foreign trade and of the trade importance of specific subjects. Textbook, class discussion, and class topics. Class trip to Boston at an estimated expense of twelve to fifteen dollars.

3 class hours. Credit, 3.

The Department.

88. III. Business Accounting. — For seniors; juniors may elect. This course aims to give the student an elementary working knowledge of the principles underlying the accounting system in the gathering, analysis, and interpretation of accounting data, and of the methods used in accounting and preparing the usual types of business statements. The managerial uses of accounting as a means of business control are the keynote of the course.

2 class hours. 3 2-hour laboratory periods, credit, 5.

Admission by permission of the instructor only.

Professor Lindsey.

Agricultural Education.

Professor Welles, Professor Glick, Mr. Heald.[1]

The primary aim of the department is to train students for service in some form of educational work. The department seeks to be of the greatest possible service to students who are preparing to teach and whose scholastic standing and general qualifications seem to make them suitable candidates for positions. Students desiring state approval as teachers of agriculture or related subjects should confer with the head of the department as early as possible, to insure a desirable range of preparation, including farm experience, a part of which may be gained after entering college. They should also become acquainted with the State Agent for Agricultural Teacher-Training, who approves candidates for positions

[1] State Agent for Agricultural Teacher-Training representing the State Department of Education in the administration of vocational education acts.

in special schools and departments of agriculture in high schools. A Teacher-Training certificate will be awarded by the Vocational Educational Division to students who qualify as to farm experience, technical subjects, and educational courses as advised. The department recommends to the State Department of Education such graduates of the college as are entitled to receive the high school teachers' term certificate. Students who major in other departments but expect to teach should consult this department regarding the educational courses best suited to their purposes.

Elective Courses.

29. III. Problems in American Education. — For sophomores; juniors and seniors may elect. The aim of this course is to introduce the student to the field of education through the study of the educational problems in the history of America from the beginning of the Colonial period to the present time. Such an understanding is to be desired in order that the citizens of tomorrow may be able to solve their own educational problems to better advantage.
3 class hours. Credit, 3.
Professor Welles.

51. I. and II. Principles and Methods of Teaching. — For juniors; seniors may elect. The course is intended only for those students who expect to become teachers. Others must consult the head of the department before registering. The course is based on a good textbook and consists of a study of the general principles of teaching and school management applied to particular "cases" taken from actual experience in public school work. Discussions of the rational solutions of these "cases" tend to fix the ideas in methods. Certain assigned and optional readings, which are both technical and inspirational in character, cover the best that has been printed on the subject of methods of teaching. They are supported by sharp class discussions of the main issues. Observation visits to schools in session are required, with full written reports. Exercises in teaching under supervision are also required, with criticism and discussion of methods and results.
5 class hours. Credit, 5.
Professor Welles.

52. I. History and Philosophy of Education. — For seniors and graduate students; juniors may elect. A general course in the history of educational theory and practice. Special emphasis is placed upon the philosophical background of education.
5 class hours. Credit, 5.
Professor Glick.

55. I and II. General Psychology. — For juniors; seniors and graduate students may elect. This is an introductory course for those anticipating further study in psychology, as well as a practical and cultural course for those who can take only one course in this field. It deals with the fundamental principles of psychology and their application to the understanding and control of human thought and action.
5 class hours. Credit, 5.
Professor Glick.

56. II and III. Educational Psychology. — For juniors; seniors and graduate students may elect. A direct application of psychology to the field of education, and a basic course for both general and specific methods. The course deals with the original nature of the child, the psychology of learning, individual differences, transfer of training, mental tests, etc. Intended primarily for prospective teachers, but open to others who are sufficiently interested.
5 class hours. Credit, 5.
Professor Glick.
Prerequisite, Agricultural Education 55 or consent of the instructor.

75. **III.** Principles of Secondary Education. — For seniors; juniors may elect. This is a study of the American high school. It is designed to acquaint the student with the aims of high school education, the characteristics and tendencies of high school students, the high school curriculum, extra-curricular activities, and the best ideas in regard to the administration of high schools.
3 class hours. Credit, 3.
Professor Welles.

76. **I** and **II.** Vocational Agricultural Teaching. — For juniors; seniors and graduate students may elect with permission of the head of the department. The course demands certain prerequisites of experience and objective which make permission necessary. It is the first of the series (76, 78, 82) and gives an introduction to the work of teaching agriculture in secondary schools, with essential information and observation preparatory to apprenticeship before the second term of the senior year.
3 class hours. Credit, 3.
Professor Welles and Vocational Division of State Department of Education.

77. **III.** Methods in Extension Teaching. — For seniors; juniors and others qualified may elect. Candidates must consult the head of the department before registering. The course deals with various phases of extension work and the methods by which this work is accomplished. The specific lines are those of the county agent, boys' and girls' club leader, county demonstration agent, and agricultural specialist. The different phases of the work will be discussed by members of the Extension staff who are specialists in their particular lines. The course will be offered jointly by the Extension Service and the Department of Agricultural Education.
3 class hours. Credit, 3.
Professor Welles and Extension Service Staff.

78. **I, II,** and **III.** Apprentice Teaching. — For juniors or seniors by arrangement with the head of the department. Under certain conditions a student may be absent from college one term of his junior or senior year for apprentice teaching, depending upon the availability of an apprentice opening, and satisfaction of the other conditions. This is part of the required preparation leading to the Special Certificate for Teachers of Agriculture and is a substitute for Course 80 in these cases. It should be completed before the winter term of the senior year.
Credit, 5.
Professor Welles and Vocational Division of State Department of Education.

79. **III.** Tests and Measurements. — Limited to fifteen seniors majoring in the department. A study of the development, theory, and construction of the various types of tests and measurements, with special emphasis upon their use in the schools. Practice is given in the administration and scoring of tests. Modern statistical methods are applied to the interpretation of the results.
2 class hours. 1 2-hour conference period, credit, 3.
Professor Glick..

80. **I, II,** and **III.** Supervised Teaching. — For seniors; juniors and others qualified may elect. No student will be admitted to the course without special arrangement with the head of the department. The course includes (*a*) practice teaching, and (*b*) observation. Opportunities for practice teaching are found on the campus and in nearby high schools. A limited amount of study of teaching by observation is permissible. Each student is required to pursue a course of professional reading bearing upon the subject he is teaching or observing. The amount of credit depends upon the number, character, and length of teaching or observation exercises and conferences.
Credit, 1 to 5.
The Department.

81. III. Seminar in Methods of Teaching. — Open to seniors majoring in agricultural education; graduate students and others by arrangement. This is an opportunity for those definitely intending to teach, to make further studies of methods in special lines other than agriculture, which is provided for in Course 76.

1 2-hour conference period, credit, 2.
Professor Welles.

Prerequisites, Agricultural Education 51 and 56, or equivalents.

82. II. The Technique of Teaching Agriculture. — For seniors and graduate students by arrangement with the head of the department; juniors in exceptional instances. This course follows Courses 76 and 78. While these are not absolute prerequisites, it will be an exceptional case in which any other order is permitted. This course covers the material, methods, policies, and special requirements of the state for agricultural teaching.

3 class hours. Credit, 3.
Professor Welles and Vocational Division of State Department of Education.

83. III. Seminar in Applied Psychology. — For seniors and graduate students. Intended for those who desire to study the application of psychology in special fields, such as salesmanship, advertising, medicine, law, public office, extension work, education, business, etc.

1 2-hour conference period, credit, 2.
Professor Glick.

Prerequisites, Agricultural Education 55, and 56 or 85.

85. I. Vocational Psychology. — For seniors and graduate students. An application of psychology to the various fields of thought and action other than education.

3 class hours. Credit, 3.
Professor Glick.

Prerequisite, Agricultural Education 55 or consent of the instructor.

95. II. Modern Philosophy of Education. — For seniors and graduate students; juniors may elect. A general survey of modern philosophical theories and tendencies, with special emphasis upon their influence in determining present educational objectives and procedures. An analysis of the theories underlying various national cultures and ideals, and the significance of education in realizing definite educational objectives.

3 class hours. Credit, 3.
Professor Glick.

Economics, History, and Sociology.

Professor Mackimmie, Assistant Professor Cutler, Assistant Professor Jefferson, Mr. Williams.

The courses in economics and history are planned with the purpose of giving the student that knowledge and understanding of the important factors and problems in this field of study and life which every active citizen and educated man ought to have.

The courses in sociology help equip a student for service as county agent, as agricultural or industrial or social economist, as family or boy's club or medical or psychiatric social worker, and as teacher of social science in high schools.

Economics.

Required Course.

25. I. Economic Principles. — For sophomores. Definitions of economic terms, such as wealth, capital, value, etc.; factors of production, exchange, and consumption; principles of economic production, supply and demand, diminishing returns, division of labor, productive organization; prin-

ciples of exchange, theories of value, money and its problems; international trade, tariff and free trade theories; forms of income, wages, interest, rent, profits, and the forces which govern them; principles of spending, economy, luxury; principles and agencies for saving, investments, banks, building associations, insurance. Textbook and readings.
3 class hours. Credit, 3.
Professor MACKIMMIE.

Elective Courses.

51. **II.** BUSINESS AND INDUSTRY. — For juniors and seniors. The forms, organization, administration, and labor problems of business. Methods of organizing, financing, and administering corporations and partnerships; forms of business administration, wholesaling, jobbing, retailing, advertising, credits and collections; system of industrial remuneration for wage earners, co-operation and preserving industrial peace; problems concerned with protective legislation for workmen and employers, sweated industries, prison labor, child labor, and industrial education.
5 class hours. Credit, 5
Professor MACKIMMIE.

Prerequisite, Economics 25.

52. **III.** PUBLIC FINANCE, TAXATION, MONEY AND BANKING. — For juniors and seniors. Systems and problems of taxation as they are found in Europe and America; objects for spending public revenue; public debts and methods of organizing them; systems of money and currency problems of America; types, methods, and functions of banks; economic and financial crises and depressions in the United States; modern war finance. Readings and lectures.
5 class hours. Credit, 5.
Professor MACKIMMIE.

Prerequisite, Economics 25.

HISTORY.

Required Course.

30. **III.** AMERICAN HISTORY. — For sophomores. The rise and development of the United States, with special stress upon the origin of present conditions. Lectures and readings.
3 class hours. Credit, 3.
Assistant Professor CUTLER.

Elective Courses.

25. **II.** AMERICAN GOVERNMENT. — For sophomores; juniors and seniors may elect. A study of the structure and operation of the machinery of our government; also a study of the history of its development from its inception to the present day.
3 class hours. Credit, 3.
Assistant Professor CUTLER.

28. **I.** ECONOMIC HISTORY OF THE UNITED STATES. — For sophomores; juniors and seniors may elect. A study of the factors and forces which have affected the economic development of the United States. Special attention is focused on the working out of economic principles, and on the inter-action between the economic, social, and political conditions and institutions. Text, lectures, and prepared discussions.
3 class hours. Credit, 3.
Assistant Professor JEFFERSON.

29. **II.** ENGLISH HISTORY. — For sophomores; juniors and seniors may elect. A study of the political, social, and religious movements in England, with special reference to an understanding of English literature.
3 class hours. Credit, 3.
Professor MACKIMMIE.

50. I. Government. — For juniors and seniors. Forms and working methods of the government of Great Britain, Germany, France, Russia, Switzerland, New Zealand, and Canada; historic types and theories of government; forms and methods of Federal, State, and local governments in America; progress and problems of democracy, and new reform movements in organization and administration; new tendencies towards social legislation and extension of governmental control.
3 class hours. Credit, 3.
Professor Mackimmie.

51. II. Modern European History. — For juniors and seniors. The modern history of the principal countries of Europe, especially the great movements and revolutions that developed the nations up to the present generation.
3 class hours. Credit, 3.
Professor Mackimmie.

52. III. European History Since 1870. — For juniors and seniors. The Franco-Prussian War and the formation of the German Empire; the unification of Italy; the Third French Republic; European expansion in the East; the Russo-Japanese War; and the origin, events, and results of the War of 1914. While a continuation of Course 51, this course will be complete in itself and may be elected by those who have had no history training. Its aim is to provide the basis for an understanding of present-day conditions and for an intelligent participation in world affairs.
3 class hours. Credit, 3.
Professor Mackimmie.

Sociology.

Elective Courses.

27. I. Elements of Sociology. — For sophomores; juniors and seniors may elect. A study of the individual considered as a member of his various groups; the group fallacy; the conditioned reflex; emotion; personality; social behavior; social stimulation; the group and the crowd; social attitudes, ideals, and adjustments; influence of environment; rural life; field and viewpoint of scientific sociology. Lectures and readings.
3 class hours. Credit, 3.
Assistant Professor Cutler.

50. I. 51. II. 52. III. Sociological Laws and their Application. — For juniors; seniors may elect. A study of the scientific principles which characterize the relation of the individual to his various groups — the family, the school, the club, recreational institutions, the church, business, the government, and others. Practical application. This study is especially directed toward rural phases of the subject. Lectures, readings, field work, discussions, and topical reports. These courses are sequential, but may be elected independently; together with Course 27, they constitute the basic series in sociology.
3 class hours. Credit, 3.
Assistant Professor Cutler.

Prerequisite, Sociology 27, or the consent of the instructor.

54. II. Civilizations, Ancient and Modern. — For juniors; seniors may elect. The evolutionary origin and history of man; characteristics of primitive man, departure from the animal status and beginnings of civilization; origin and development of industries, arts, and sciences; the evolution of languages, warfare, migrations, and social institutions; a study of the powerful natural and human forces that have brought man from the early stages to modern development; characteristic features of the leading civilizations and races of ancient and modern times; beneficial and dangerous factors in American life.
5 class hours. Credit, 5.
Assistant Professor Cutler.

Prerequisite, Sociology 27.

55. **III.** The History of Religions. — For juniors; seniors may elect. This course will consist of a rapid survey of primitive religions, and of the religions of India, China, and Greece. Its aim will be to acquaint the student with the historical facts concerning these religions and also to give him an understanding of the spirit and the needs which prompted their rise. Consideration will be given to the application of the material of the course to current religious problems. The elements of similarity between these religions and the Christian religion will also be discussed.
3 class hours. Credit, 3.
Mr. Williams.

75. **I.** Social Institutions and Social Reforms. — For seniors; juniors by permission. Social institutions, such as the family, the State, property, religions; and such current problems as eugenics, race suicide, divorce, crime and delinquent classes, prison reform, prevention and treatment of dependents and defectives, poverty, its causes and preventions; constructive modern social reform movements for insurance of wage earners, protection of childhood, assurance of safety, health, and play time for all classes. The correctional and charitable institutions of Massachusetts are studied in considerable detail.
5 class hours. Credit, 5.
Assistant Professor Cutler.
Prerequisites, Sociology 50, 51, and 52, or the consent of the instructor.

76. **I.** Field Work in Sociology. — For seniors; juniors may elect. Designed to meet the needs of students who wish to do some constructive work in social service while still in college. The work is carried on in co-operation with the various college agencies engaged in rural service. Any project for which credit in this course is to be asked must first have the approval of the head of the department.
2 to 6 laboratory hours, credit, 1 to 3.
Assistant Professor Cutler.
Prerequisites, Sociology 27, or 50, 51, and 52.

77. **II.** Sociological Research. — For seniors; juniors may elect. Research methods — measurements, exploration, criticism, surveys; observation, comparison, and correlation; a careful study of the scientific method as applied to social problems; the technique of investigation and research; the procedure of gathering sociological data by means of the survey; the interpretation and graphic presentation of social facts. Text, lectures, field and laboratory work.
3 class hours. Credit, 3.
Prerequisites, Sociology 50, 51, and 52, or the consent of the instructor.
Assistant Professor Cutler.

79. **I.** 80. **II.** 81. **III.** Seminar. — Enrolment is open to graduate students, and seniors majoring in social science, who are especially prepared. Topics recently studied are: sociology of American colonies in the Caribbean region; success in rural leadership; rural sociology of the Old World and Far East; the standard of living in American rural life; proposed improvements in rural local government; international agricultural problems. Courses are sequential but may be elected independently.
2 class hours. Credit, 2.
Professors Mackimmie and Cutler.

Languages and Literatures.

Professor Patterson, Professor Julian, Associate Professor Prince, Associate Professor Rand, Assistant Professor Dunbar, Assistant Professor Goding, Mr. Durkee, Mr. Goldberg, Miss Packard.

The courses in English are intended to enable students to express themselves effectively and to appreciate the ideals of English-speaking people throughout their history.

The aim of the courses in French, Spanish, and German is to give the student a practical knowledge of these languages for the purpose of wider reading and

research, to introduce him to some of their treasures in art and science, and through the literature to acquaint him with the people.

The courses in History and Interpretation of Music are non-technical in treatment and are intended for those who wish a background of the history of music and its interpretation.

English.

Required Courses.

1. **I.** 2. **II.** 3. **III.** English. — For freshmen. Composition. Intended to teach straight thinking, sound structure, clear and correct expression. Lectures, recitations, theme writing, and conferences.
3 class hours. Credit, 3.
Professors Patterson, Prince, Rand, Mr. Goldberg, and Miss Packard.

25. **I.** 26. **II.** 27. **III.** English. — For sophomores. A general reading course in English literature.
2 class hours. Credit, 2.
Professor Patterson.

28. **I.** 29. **II.** 30. **III.** English. — For sophomores. Public speaking.
1 class hour. Credit, 1.
Associate Professors Prince and Rand, Mr. Goldberg, and Miss Packard.

Elective Courses.

50. **III.** English Poetry and the Romantic Movement (1929–30). — Alternates with Course 67. For juniors and seniors. A study chiefly in the beginning of Romanticism in English Poetry as found in the work of Collins, Gray, Burns, and Blake, with considerable attention to the culmination of Romanticism in the poetry of Shelley.
3 class hours. Credit, 3.
Associate Professor Prince.

51. **II.** English Poetry in the Nineteenth Century (1930–31). — Alternates with Course 54. For juniors and seniors. Especial attention is given to Landor, Tennyson, Arnold, and Clough.
3 class hours. Credit, 3.
Professor Patterson.

52. **II.** English Writers from Milton to Pope. — For juniors; seniors may elect. Some of the writers studied are Milton, Bunyan, Dryden, and Pope.
3 class hours. Credit, 3.
Professor Patterson.

53. **II.** English Prose of the Eighteenth Century. — For juniors; seniors may elect. A brief exposition of the thinking of the period, in philosophy, government, and criticism is followed by a study of essayists and letter writers from Defoe to Godwin.
3 class hours. Credit, 3.
Associate Professor Prince.

54. **II.** English Prose in the Early Nineteenth Century (1929–30). — Alternates with Course 51. For juniors and seniors. Coleridge, Lamb, De-Quincey, Hazlitt, Macaulay.
3 class hours. Credit, 3.
Professor Patterson.

55. **II.** American Prose. — For juniors; seniors may elect. A course in the chief American prose writers, among those studied being Franklin, Brockden Brown, Irving, Cooper, Poe, Melville, Hawthorne, Emerson, Thoreau, Parkman.
3 class hours. Credit, 3.
Associate Professor Prince.

56. **III.** American Poetry. — For juniors; seniors may elect. A course in the chief American poets, among those studied being Freneau, Bryant, Poe, Emerson, Longfellow, Whittier, Lowell, Whitman, Lanier.
3 class hours. Credit, 3.
Associate Professor Prince.

57. **III.** Browning and the Prae-Raphaelites. — For juniors; seniors may elect. The course will be devoted especially to Browning and Swinburne, with some attention to Dante Gabriel Rossetti and William Morris.
3 class hours. Credit, 3.
Professor Patterson.

58. **III.** English Prose of the Victorian Age. — For juniors; seniors may elect. The essayists will be considered, especially Carlyle, Ruskin, Newman, Arnold, Pater, and Stevenson.
3 class hours. Credit, 3.
Mr. Goldberg.

60. **I.** Keats and Byron. — For juniors; seniors may elect.
3 class hours. Credit, 3.
Professor Patterson.

61. **II.** Chaucer. — For juniors; seniors may elect. Reading of the principal works of Chaucer; a study of Chaucer's development as a creative artist; an attempt to appreciate his humanism.
3 class hours. Credit, 3.
Associate Professor Prince.

63. **III.** Shakespeare (1929–30). — Alternates with Course 75. For juniors and seniors. Three or four representative plays will be studied as closely as possible.
3 class hours. Credit, 3.
Professor Patterson.
Prerequisite, English 79.

64. **I.** The Lake Poets. (1931–32). — Alternates with Course 68. For juniors and seniors. A study of the background, the theories and the poetry of the Lake Poets, the leaders of whom were Wordsworth and Coleridge.
3 class hours. Credit, 3.
Associate Professor Rand.

65. **I.** Advanced Composition. — For juniors; seniors may elect. Advanced work in expository writing, based upon specimens by contemporary authors and upon the personal experience of the student. Particular attention is given to organization and style.
3 class hours. Credit, 3.
Associate Professor Rand.

66. **II.** Theses. — For juniors; seniors may elect. The preparation of theses and similar manuscripts upon subjects selected by the student. An orderly accumulation of material is followed by an intelligent and readable interpretation of its significance.
3 class hours. Credit, 3.
Associate Professor Rand.

67. **III.** Narrative Writing (1930–31). — Alternates with Course 50. For juniors and seniors. Journalistic and fictional narrative with supplementary reading. Especial attention is given to the writing of the short story.
3 class hours. Credit, 3.
Associate Professor Prince.

68. **I.** The Tudor Poets (1930–31). — Alternates with Course 64. For juniors and seniors. A study of the non-dramatic poetry of the Tudor period, culminating in the work of Edmund Spenser and the Elizabethan lyrists.
3 class hours. Credit, 3.
Associate Professor Rand.

71. **I.** Elizabethan Dramatists. — For juniors; seniors may elect. A study of the types of Elizabethan drama, exclusive of Shakespeare, with special consideration of the plays of such men as Lyly, Peele, Greene, Kyd, Marlowe, Jonson, Beaumont, Fletcher, Webster, Massinger.
3 class hours. Credit, 3.
Associate Professor Prince.

75. **II.** The Novel (1930–31). — Alternates with Course 63. For juniors and seniors. A rapid survey of the beginnings of the novel will be followed by a somewhat careful study of its types and development as revealed in such works as Tom Jones, Vicar of Wakefield, Pride and Prejudice, Ivanhoe, David Copperfield, Vanity Fair, Kidnapped, Tess of the D'Urbervilles, Esther Waters, Rise of Silas Lapham, House of Mirth.
3 class hours. Credit, 3.
Professor Patterson.

79. **II.** Shakespeare. — For seniors; juniors may elect. A cursory survey of the origin and rise of English drama is followed by the reading of about fifteen of Shakespeare's plays, selected to indicate the evolution of the dramatist and to emphasize the various phases of his art.
3 class hours. Credit, 3.
Associate Professor Rand.

80. **III.** Modern Drama (1930–31). — Alternates with Course 81. For juniors and seniors. This course will trace the development of English drama from Robertson to the present day. The purpose of the course is to impart an intelligent and sympathetic interest in the theatre of the twentieth century.
3 class hours. Credit, 3.
Associate Professor Rand.

81. **III.** Modern Verse (1929–30). — Alternates with Course 80. For juniors and seniors.
3 class hours. Credit, 3.
Associate Professor Rand.

Public Speaking.

Elective Courses.

50. **I.** Argumentation (1930–31). — Alternates with Course 52. For juniors and seniors. Presents the fundamental principles of argumentation as applied to oral and written discourse, and develops in the student power to handle argument convincingly and persuasively. Lectures, discussions of leading questions of the day, practice in brief-drawing and the writing of forensics. The course is recommended for those who desire to enter the intercollegiate debates.
3 class hours. Credit, 3.
Associate Professor Prince.

51. **III.** Occasional Oratory. — For juniors; seniors may elect. A study of the principles and the practice of formal oratory; the preparation and delivery of one original oration; prescribed reading in oratory. The course is recommended for those who wish to enter the Flint Contest.
3 class hours. Credit, 3.
Associate Professor Prince.

52. I. Extempore Speaking (1929–30.) — Alternates with Course 50. For juniors and seniors. The course is intended to give the student practice in thinking upon his feet and in presenting cogently his thinking to a public group.
3 class hours. Credit, 3.
Associate Professor Prince.

French.

Elective Courses.

1. I. 2. II. 3. III. Elementary French. — Required of freshmen who do not elect German and who have not presented French for entrance; sophomores, juniors, and seniors may elect. The essentials of grammar are rapidly taught and will be accompanied by as much reading as possible.
3 class hours. Credit, 3.
Assistant Professor Goding.

4. I. 5. II. 6. III. Intermediate French. — Required of freshmen who present two years of French for entrance and who do not elect German; sophomores, juniors, and seniors may elect. Training for rapid reading. The reading of a number of short stories, novels, and plays; composition, reports on collateral reading from periodicals and scientific texts in the library.
3 class hours. Credit, 3.
Assistant Professors Dunbar and Goding.
Prerequisites, French 1, 2, and 3, or Entrance French.

25. I. 26. II. 27. III. Intermediate French. — For sophomores; juniors and seniors may elect. Training for rapid reading. The reading of a number of short stories, novels, and plays; readings from periodicals and scientific texts in the library.
3 class hours. Credit, 3.
Assistant Professor Dunbar.
Prerequisites, French 1, 2, and 3.

28. I. 29. II. 30. III. Advanced French. — For sophomores; juniors and seniors may elect. A general survey of the history of French literature and the development of French culture, with representative works of the important periods. Lectures. Outside readings.
3 class hours. Credit, 3.
Assistant Professor Goding.
Prerequisites, French 4, 5, and 6, or 25, 26, and 27.

50. I. French Literature. — For juniors; seniors may elect. A detailed study of the Romantic period. Readings from Hugo, de Vigny, Lamartine, de Musset, and others. Influence of English, German, and Italian literature is stressed. Lectures and outside readings.
3 class hours. Credit, 3.
Assistant Professor Goding.
Prerequisites, French 4, 5, and 6, or 25, 26, and 27.

51. II. French Literature. — For juniors; seniors may elect. A detailed study of the Realistic period. Readings from Balzac, Flaubert, Stendhal, and others. Lectures, outside readings.
3 class hours. Credit, 3.
Assistant Professor Goding.
Prerequisites, French 4, 5, and 6, or 25, 26, and 27.

52. III. French Literature. — For juniors; seniors may elect. Later nineteenth century and modern French literature. Readings from Rostand, Loti, Daudet, Anatole France, and others. Discussions of contemporary authors. Modern criticism.
3 class hours. Credit, 3.
Assistant Professor Goding.
Prerequisites, French 4, 5, and 6, or 25, 26, and 27.

75. I. 76. II. 77. III. French Literature. — For seniors; juniors may elect. Survey of the Classical period, with readings from representative works.
2 class hours. Credit, 2.
Assistant Professor Dunbar.
Prerequisites, French 4, 5, and 6, or 25, 26, and 27.

81. III. Methods of Teaching French. — For seniors; juniors may elect with the consent of the instructor. This course is designed to meet the needs of students intending to teach French and those desiring a more accurate knowledge of the French language. The elements of pronunciation will be studied scientifically and from the standpoint of the teacher. There will be a rapid but thorough review of grammar which will be followed by a discussion on text-books and reading materials.
2 class hours. Credit, 2.
Assistant Professor Goding.
Prerequisites, French 4, 5, and 6, or 25, 26, and 27, and, in addition, one year of advanced French.

Spanish.

Elective Courses.

50. I. 51. II. 52. III. Elementary Spanish. — For juniors; seniors may elect. Open to other students upon arrangement. Grammar, exercises in composition and conversation, reading of selected short stories.
3 class hours. Credit, 3.
Assistant Professor Dunbar.

75. I. 76. II. 77. III. Modern Spanish Authors. — For seniors. Reading from modern Spanish novel and drama; composition; outside reading.
2 class hours. Credit, 2.
Assistant Professor Dunbar.
Prerequisite, Spanish 52.

Music.

Elective Courses.

50. I. History and Interpretation of Music. — For juniors; seniors may elect. The Classical School. Works of Bach, Handel, Haydn, and Mozart are performed and studied. Lectures, musical illustrations, and outside readings.
2 scheduled hours. Credit, 1.
Laboratory fee, $1.50. Assistant Professor Goding.

51. II. History and Interpretation of Music. — For juniors; seniors may elect. A continuation of Course 50. The Romantic School — Beethoven, Schubert, Weber, Mendelssohn, Schumann, Chopin, Berlioz, Liszt.
2 scheduled hours. Credit, 1.
Laboratory fee, $1.50. Assistant Professor Goding.

52. III. History and Interpretation of Music. — For juniors; seniors may elect. The Italian, French, and German schools of opera; modern and contemporary composers.
2 scheduled hours. Credit, 1.
Laboratory fee, $1.50. Assistant Professor Goding.

75. I. 76. II. 77. III. Ensemble Music. — For juniors and seniors. The purpose of this course is to train students of average ability to play ensemble music. Group technique will be stressed. Persons with fundamental knowledge of, or some training on, any instrument should profit by the laboratory practice. The nature of the practice work will be determined by the instruments available, but it is hoped that a full orchestra can be regularly maintained.

Smaller combinations, such as ensembles of any sort, will be fostered when at all possible. Concerts of a semi-public nature will be given by the members of the course. Lectures, laboratory practice.
3 scheduled hours. Credit, 2.
Laboratory fee, $1.50 per term. Assistant Professors Goding and Cubbon.

German.

Elective Courses.

1. **I.** 2. **II.** 3. **III.** Elementary German. — Required of freshmen who do not elect French and who have not presented German for entrance; sophomores, juniors, and seniors may elect. Grammar, reading, and prose composition. Special emphasis is placed on the acquirement of a fundamental stem vocabulary and the ability to understand simple German paragraphs in German.
3 class hours. Credit, 3.
Professor Julian and Mr. Durkee.

4. **I.** 5. **II.** 6. **III.** Intermediate German. — Required of freshmen who present two years of German for entrance and who do not elect French; sophomores, juniors, and seniors may elect. Shorter stories of Baumbach, Gerstäcker, Heyse, Keller, Wildenbruch; selected works of Schiller; grammar review and advanced prose composition.
3 class hours. Credit, 3.
Mr. Durkee.
Prerequisites, German 1, 2, and 3, or Entrance German.

25. **I.** 26. **II.** 27. **III.** Intermediate German. — For sophomores; juniors and seniors may elect. The German short story; grammar review and advanced prose composition.
3 class hours. Credit, 3.
Mr. Durkee.
Prerequisites, German 1, 2, and 3.

28. **I.** 29. **II.** 30. **III.** Advanced German. — For sophomores; juniors and seniors may elect. Reading and study of some important literary productions in the field of the novel and the drama.
3 class hours. Credit, 3.
Professor Julian.
Prerequisites, German 4, 5, and 6, or 25, 26, and 27.

50. **I.** 51. **II.** 52. **III.** Scientific German. — For juniors and seniors. Intensive and specialized reading of literature in standard German scientific journals and reference books.
3 class hours. Credit, 3.
Professor Julian.
Prerequisites, German 4, 5, and 6, or 25, 26, and 27.

75. **I.** 76. **II.** 77. **III.** German Literature. — For seniors. Advanced language and literary study, conducted entirely in German. Lectures on German literature and history; collateral readings, including masterpieces of different epochs, such as *Niebelungenlied*, Goethe's *Faust*, and a typical modern drama.
3 class hours. Credit, 3.
Professor Julian.
Prerequisites, German 28, 29, and 30.

GENERAL DEPARTMENTS.

Military Science and Tactics.

Major N. Butler Briscoe, Cav. (D. O. L.), U. S. A.; Major Eustis L. Hubbard, Cav. (D. O. L.), U. S. A.; Captain Edwin M. Sumner, Cav. (D. O. L.), U. S. A.; Technical Sergeant John J. Lee, U. S. A., Retired; Technical Sergeant James A. Warren, Cav. (D. E. M. L.), U. S. A.; and a detachment of enlisted men of the United States Army.

Under act of Congress, July 2, 1862, the College was required to provide a two-year course in military instruction under a regular army officer. All able-bodied four-year male students are required to take this course. Under act of Congress, June 3, 1916, as amended by act of Congress, September 8, 1916, there was established at this college in April, 1917, an infantry unit of the Reserve Officers' Training Corps. Following the World War and an act of Congress, July 9, 1918, the Reserve Officers' Training Corps has been in operation under the regulation of the War Department, administered by the president of the college and the professor of military science and tactics. Beginning with the fall term, 1920–21, the infantry unit of the Reserve Officers' Training Corps was converted into a cavalry unit.

The primary object of the Reserve Officers' Training Corps is to provide systematic military training at civil educational institutions, for the ultimate purpose of qualifying selected students of such institutions as reserve officers in the military forces of the United States. It is intended to attain this object during the time the students are pursuing their general or professional studies, with the least practicable interference with their civil careers, by employing methods designed to fit men physically, mentally, and morally for pursuits of peace as well as war.

The course for cavalry units of the Reserve Officers' Training Corps includes theoretical and practical instruction in all phases of cavalry work, so distributed over the four-year college course as to qualify students at the end of the freshman year as privates of cavalry, at the end of the sophomore year as non-commissioned officers of cavalry, and upon graduation as reserve officers. The instruction in this department covers cavalry drill, cavalry weapons — rifle, pistol saber, automatic rifle, and machine gun — map reading and military sketching minor tactics, equitation, etc. The course in equitation includes cross-country riding and instruction in polo. Fifty-three per cent of the course is classroom work. All practical instruction is out of doors.

All male candidates for a degree in the four-year course must take at least three hours a week of military training for two years. Students who are approved by the president and the professor of military science and tactics may take the advanced course in their junior and senior years if they so elect. The advanced course consists of at least five hours per week and a summer camp of about six weeks during the summer vacation between the junior and senior years. Students taking this course are paid by the Federal Government at a rate to be fixed by the Secretary of War, not to exceed the value of the army ration. The rate now fixed is thirty cents per day, which, with all allowances, amounts to about two hundred and thirty-five dollars. Students graduating in the advanced course are eligible for commissions in the Officers' Reserve Corps, but are not required to accept such commissions if offered.

The uniform furnished to the freshmen and sophomores (basic course) is of olive drab woolen cloth, and is supplied by the Federal Government without cost except for the necessary alterations. The uniforms for the juniors and seniors (advanced course) are of forest green woolen cloth, tailor-made for the individual student. A deposit of thirty dollars for this uniform is required at the beginning of the junior year. The student is reimbursed through the allowances for clothing and rations.

Required Courses.

1. **I.** 2. **II.** 3. **III.** For freshmen. Theoretical and practical instruction in courtesy and discipline, riding, rifle marksmanship, hygiene and sanitation, drill, and history.

3 scheduled hours, credit, 2.
Army Instructors.

25. **I.** 26. **II.** 27. **III.** For sophomores. Theoretical and practical instruction in leadership, riding, drill, saber, automatic rifle and pistol, mounted sports, and polo.

3 scheduled hours, credit, 2.
Army Instructors.

Elective Courses.

50. **I.** 51. **II.** 52. **III.** For juniors. Cavalry drill and riding, selection and care of horses, pistol marksmanship, machine guns, map reading, map making, mounted sports, jumping, polo.

5 scheduled hours, credit, 3.
Army Instructors.

75. **I.** 76. **II.** 77. **III.** For seniors. Military law, history, correspondence and records, engineering (bridges and explosives), cavalry drill, leadership and command, riding, mounted sports, competitions, horse-show preparation and management, polo, cross-country riding.

5 scheduled hours, credit, 3.
Army Instructors.

Physical Education and Hygiene.

Professor Hicks, Professor Gore, Mrs. Hicks, Assistant Professor Derby, Mr. Ball, Mr. Briggs, Mr. McGeoch.

The purpose of the laboratory courses offered by this department is to provide active exercise regularly, in order that all students may properly care for their health and maintain their physical condition throughout their college course. It is also hoped that the health and exercise habits thus established will be continued after leaving college. The course in Hygiene for men is a series of lectures designed to give to the new student the simple rules of living both as an individual and in his relations with others. The required courses for men and for women are supplemented by special lectures on social hygiene and social relations. The elective courses for men are offered for those students who are preparing to teach. The majority of our graduates who enter the teaching profession in either the public or private schools are expected to do some physical education or athletic work either as coaches or administrators.

[All undergraduate male students are given a physical examination upon entering. All undergraduate women students are required to present as a part of their entrance record, a form report of a physical examination by their family physician.]

Men.

Required Courses.

1. **I.** Hygiene. — For freshmen. Lectures on personal hygiene, including the physiological basis for sound health habits, the importance of the systematic planning of a student's daily program in order to provide the proper amounts of time for study, with suitable periods of sleep, relaxation, recreation, and sports; posture, appropriate types of exercise, proper nutrition, social adjustment, the necessity for frequent medical, optical, and dental advice; sanitation and group health requirements.
1 class hour. Credit, 1.
Professor Hicks.

2. **I.** Recreation. — For freshmen. Outdoor games are taken up progressively and include soccer, touch football, kick football, and cricket. Men may elect freshman football, cross-country, track, or baseball. The course gives every man the opportunity to develop sufficient control over his body to enable him to get pleasure from physical activities and thus develop habits of exercise which will continue in later life.

2 laboratory hours, credit, 1.
Assistant Professor Derby and Messrs. Ball, Briggs, and McGeoch.

3. **III.** Recreation. — For freshmen. Outdoor games in the regular class work include long base, playground ball, speed ball, track and field events, and volley ball. Men may elect tennis, golf, polo, freshman baseball or track, or varsity football. The course aims to encourage health habits and to give a fund of exercise material for use in after-school days.

2 laboratory hours, credit, 1.

Assistant Professor Derby and Messrs. Ball, Briggs, and McGeoch.

25. **I.** Recreation. — For sophomores. Continuation of Course 2, with more difficult skills and co-ordinations. Emphasis is placed on healthful, big-muscle activities, and the guidance of play spirit. Soccer, touch football, kick football, and cricket are played. Men may elect tennis, golf, polo, varsity football, baseball, track, or cross-country.

2 laboratory hours, credit, 1.

Assistant Professor Derby and Messrs. Ball, Briggs, and McGeoch.

26. **III.** Recreation. — For sophomores. Continuation of Course 3, with progression. Increased attention is given to the games that provide situations that will give instruction in citizenship through leadership and response to commands. Opportunity is given for self-expression through games. Playground ball, speedball, track and field events, and volley ball are played. Men may elect tennis, golf, polo, varsity football, baseball, or track.

2 laboratory hours, credit, 1.

Assistant Professor Derby and Messrs. Ball, Briggs, and McGeoch.

Elective Courses.

74. **I.** Outline Course for Teacher-Coaches. — For seniors. Admission by permission only. This course outlines the coaching of football and soccer, theory of coaching and coaching psychology, and health education programs for secondary schools. Lectures, collateral readings, theory situations, normal practice, and notebook.

2 class hours. 1 2-hour laboratory period, credit, 2.

Professor Gore, Assistant Professor Derby, Mr. Ball, and Mr. Briggs.

75. **II.** Outline Course for Teacher-Coaches. — For seniors. Admission by permission only. Continuation of Course 74. This course includes the outline of coaching basketball, hockey, boxing, and wrestling; school programs of physical education, training, first aid, and care of injuries. Lectures, collateral readings, theory situations, normal practice, and notebook.

2 class hours. 1 2-hour laboratory period, credit, 2.

Professor Gore, Assistant Professor Derby, Mr. Ball, Mr. Briggs, and Mr. McGeoch.

76. **III.** Outline Course for Teacher-Coaches. — For seniors. Admission by permission only. Continuation of Courses 74 and 75. This course outlines the coaching of baseball and track, the teaching of miscellaneous games, intramural athletics, scout and camp craft, and the relation of athletics and humanics. Lectures, collateral readings, theory situations, normal practice, and notebook.

2 class hours. 1 2-hours laboratory period, credit, 2.

Professor Gore, Assistant Professor Derby, Mr. Ball, and Mr. Briggs.

77. **II.** History and Purposes of Physical Education. — For seniors. Admission by permission only. A brief study of the history of the development of the various systems of physical education and of the men who promoted them; a study of the aims and ideals of present day physical educators; a study of some of the problems of athletic supervision and physical education administration. This course is intended for those who expect to deal with adminis-

trative problems of school programs of physical education and athletics. Lectures, recitations, reports on assigned readings, and a final outline of a school problem.
2 class hours. Credit, 2.
Professor Hicks.

Women.

Required Courses.

4. **I.** Recreation. — For freshmen. Outdoor games.
3 scheduled hours, credit, 2.
Mrs. Hicks.

5. **II.** Gymnastics. — For freshmen. Body mechanics, folk and national dancing, gymnastics.
3 scheduled hours, credit, 2.
Mrs. Hicks.

6. **III.** Recreation. — For freshmen. Outdoor games.
2 scheduled hours, credit, 1.
Mrs. Hicks.

27. **I.** Recreation. — For sophomores. Outdoor games.
5 scheduled hours, credit, 3.
Mrs. Hicks.

28. **II.** Gymnastics. — For sophomores. Body mechanics, folk and national dancing, gymnastics, rhythms, games.
3 scheduled hours, credit, 2.
Mrs. Hicks.

29. **III.** Recreation. — For sophomores. Outdoor games.
5 scheduled hours, credit, 3.
Mrs. Hicks.

Elective Courses.

50. **II.** Rhythms. — For juniors. Rhythmic dancing, clog dancing.
3 scheduled hours, credit, 2.
Mrs. Hicks.

76. **II.** Rhythms. — For seniors. Rhythmic dancing, clog dancing.
3 scheduled hours, credit, 2.
Mrs. Hicks.

The Graduate School.

Roscoe W. Thatcher, D.Agr., LL.D., President of the College.

Henry T. Fernald, Ph.D., Director of the Graduate School: Professor of Entomology.

Graduate Staff, 1929–1930.

President Thatcher, Director Fernald, Dean Machmer, Heads of Divisions, Heads of Departments offering graduate courses, Professors, Associate Professors, and Assistant Professors teaching graduate subjects; R. D. Hawley, Secretary.

General Statements.

Graduate courses leading to the degrees master of science, master of landscape architecture, master of agriculture, doctor of agriculture, and doctor of philosophy have been available at the college for more than twenty years, and the graduate school work has been in great demand. Graduate students desiring advanced courses, but who do not wish to take advanced degrees, are also admitted.

Admission.

Admission to the graduate school will be granted: —

1. To graduates of the Massachusetts Agricultural College.

2. To graduates of other institutions of good standing, who have received a bachelor's degree substantially equivalent to that conferred by this college.

In case an applicant presents his diploma from an institution of accepted standing, but has not taken as much of the subject he desires to select for his major study as is required of undergraduates at the Massachusetts Agricultural College, he will be required to make up such parts of the undergraduate work in that department as the head of the department may consider necessary, without credit toward his advanced degree. In the case of minor subjects for advanced degrees, credit begins to accrue from the point where the previous training of the applicant ended, whether it be graduate or undergraduate in its rating at this college, subject however to such limitations as may be fixed by the department concerned. (See department statements.)

Applications for membership in the graduate school should be presented to the director of the school. An official transcript of the applicant's collegiate record, and a statement of the graduate work desired and whether the applicant intends to study for a degree should be submitted.

Registration as a graduate student should be promptly made at the director's office and must be renewed for each term thereafter.

The Graduate Work.

Candidates for the degree of doctor of philosophy are required to prosecute three subjects, one of which shall be designated as the major and the others as minors. No two of these subjects may be taken in the same department. An original thesis shall be considered a part of the major subject.

Candidates for the degree of doctor of agriculture are required to select a major and such other subjects as will develop the major in its greatest intensity and comprehensiveness. Successful experience is also requisite, together with a thesis which represents a masterly survey or intimate study through accurate application of some phase of the major subject.

Candidates for the degree of master of science are required to prosecute two subjects, one of which shall be designated as a major and the other as a minor.

When desirable, and approved by the director, the minor may be made up of subjects from more than one department. The major and minor subjects may not be selected in the same department. An original thesis is considered a part of the major subject.

Candidates for the degree of master of agriculture are allowed greater privileges in the selection of subjects, but will be required to select a major and such other supporting lines of study as will be necessary to equip the individual professionally. A thesis which will reveal the professional training of the individual will be required.

Candidates for the degree of master of landscape architecture will be expected to conform to the established courses of the department, and to the requirements of the department in the preparation of a thesis, as well as in actual experience outside the college.

Candidates for membership in the graduate school who do not desire to work for a degree may, with the approval of the director of the school, take more than one subject in the same department, or pursue work in several departments, if their preparation will permit. A statement of the subjects chosen must in each case be submitted to the director of the graduate school for approval. The chosen subjects must bear an appropriate relation to each other.

A working knowledge of French and German is important for successful graduate work in practically all the major lines offered by the college, and students not having this will be given an opportunity to acquire it along with their graduate work.

The graduate staff reserves the privilege of recommending and allowing courses in other institutions as a part of the work for advanced degrees at this college, whenever such a policy seems advisable. A certain amount of work in absentia may also be permitted, provided it is prosecuted under satisfactory direction and supervision, and regular and sufficient reports of progress are submitted.

Thesis.

A thesis is required of each candidate for an advanced degree. It must be on a topic belonging to the candidate's major subject, must show that its writer possesses the ability to carry on constructive study, must be an actual contribution to knowledge, and possess real merit.

The thesis in its final form must be submitted to the director by May 15 of the year in which the student is to present himself for the advanced degree, and before he may take the required examination. Three complete copies are required. One of the copies is to be retained as an official copy by the director, one is to be deposited in the college library, and the third is to be retained by the department in which the thesis was prepared. The candidate for the doctor's degree must be prepared to defend at the oral examination the views presented in his thesis.

Final Examinations.

For the degree of doctor of philosophy or doctor of agriculture, final examinations on the minors taken are given upon the completion of the subjects. In the major subject, a written examination, if successfully passed, is followed by an oral examination in the presence of the graduate staff.

For the degree of master of science, master of agriculture, or master of landscape architecture, a final examination upon the minor taken is given upon the completion of each course, and in the major a final examination, which may be either written or oral, or both, is given over all the work by the department concerned.

Degrees Conferred.

The degrees of doctor of philosophy and doctor of agriculture are conferred upon graduate students who have met the following requirements: —

1. The devotion of at least three years[1] to the prosecution of three subjects of study and research in residence at the college.

2. The earning of not less than one hundred credits in the chief or major subject, and of not less than twenty-five credits in each of two minor subjects.

[1] All time statements refer to minimum time.

3. The preparation of a thesis, in the major subject, constituting an actual contribution to knowledge and accompanied by drawings if necessary. For the degree of doctor of agriculture the thesis may be modified to meet professional requirements.

4. The passing of final examinations, in both the major and minor subjects, to the satisfaction of the instructors in charge.

5. A public oral examination.

6. The payment of all fees and college expenses required.

The degrees of master of science, master of agriculture, and master of landscape architecture are conferred upon graduate students who have met the following requirements: —

1. The devotion of at least one year and a half to the prosecution of study in two subjects of study and research, not less than one full college year of which must be in residence. In the case of a master of landscape architecture the student must follow the prescribed course of study.

2. The earning of not less than fifty credits in the chief or major subject, and of not less than twenty-five credits in the minor subject. Students pursuing the course in landscape architecture will devote all of their time to the established course, and meet the conditions of one year of experience outside the college.

3. The preparation of a thesis in the major subject, constituting an actual contribution to knowledge, and accompanied by drawings if necessary.

4. The passing of final examinations, in both major and minor subjects, to the satisfaction of the professors in charge.

5. The payment of all fees and college expenses required.

The fee for the degree of master of science, master of agriculture, or master of landscape architecture is $10, and for the degree of doctor of agriculture, or doctor of philosophy, $25.

Courses Offered.

Courses available as major subjects for the degree of doctor of philosophy: —

Agricultural Economics.
Agronomy.
Bacteriology and Physiology.
Botany.
Chemistry.
Entomology.
Horticulture.
Pomology.
Rural Sociology.

Courses available as major subjects for the degree of master of science: —

Agricultural Economics.
Agricultural Education.
Agronomy.
Animal Husbandry.
Bacteriology and Physiology.
Botany.
Chemistry.
Dairy Husbandry.
Entomology.
Horticulture.
Pomology.
Poultry Science.
Rural Sociology.

Courses available as major subjects for the degree of master of agriculture: —

Agronomy. Animal Husbandry. Poultry Science.

The course in landscape architecture leads to the degree of master of landscape architecture.

Courses available as minor subjects: —

Agricultural Economics.
Agricultural Education.
Agronomy.
Animal Husbandry.
Bacteriology and Physiology.
Botany.
Chemistry.
Dairy Husbandry.
Entomology.
Horticulture.
Landscape Architecture.
Mathematics and Physics.
Pomology.
Poultry Science.
Rural Sociology.
Veterinary Science.
Zoölogy.

General Outline of Courses for Advanced Degrees.

Agricultural Economics.

Major Requirements.

For the Degree of Doctor of Philosophy.

Prerequisite Work. — Candidates must have had the following courses or their equivalent: Economics 25, Agricultural Economics 26 and 50.

Required Work. — Candidates must take the following courses: Agricultural Economics 51, 52, 53, and 79. These courses, specially arranged for graduates, may be taken as Courses 120, 170, 155, and 160 for graduate credit. In addition, candidates must take Courses 110, 111, 130, 165, and 175 in agricultural economics; Sociology 27 and 50, or equivalent courses; and Economics 51 and 52, or equivalent courses.

Each candidate will be required to have a working knowledge of the general field of economics, the history of agricultural economics, the theory of agricultural economics, the problems of agricultural production, land tenure, land problems, agricultural commerce, agricultural co-operation, agricultural credit, statistics of agriculture, and prices, markets, and marketing.

For the Degree of Master of Science.

Prerequisite Work. — The same as for the degree of doctor of philosophy.

Required Work. —The same as for the degree of doctor of philosophy, to a total of at least fifty credits.

Graduate Courses Offered.

110. Theory of Agricultural Economics. — Readings in French, German, and English on economics of agriculture. Alternate years, odd, 200 hours. Credit, 3.
Professor Cance.

111. Current Economic Problems and Literature. — Department seminar throughout the year. Credit, 1 each term.

120. Economic History of American Agriculture. — Spring term. Credit, 3.
The Department.

121–122. History of American Agriculture. — Special studies in the history of agricultural institutions, practices, or relations. Fall term, even years. Credit, 5.
Assistant Professor Jefferson.

130. Problems of Agricultural Production. — The relation of the farmer to the food supply. May be taken in connection with Course 77. Fall term, yearly. Credit, 5.
Professor Cance.

140. Land Tenure and the Acquisition of Farm Land. — Readings, discussion, original exercises. Alternate years, even. Credit, 3–5.
Professor Cance.

145. Farm Labor. — Reading and investigation. Credit, 3
Professor Cance.

150. Agricultural Commerce, Industry and Trade. — A study of trad movements and commercial activities relating to agricultural products. Fal term, alternate years, odd. Credit, 3–5
Assistant Professor Jefferson.

155. The Agricultural Market. — A study of the forces, methods, and institutions of the market for agricultural products. Spring term, yearly.
Credit, 5
Professor Cance.

156. Specific Problems in Marketing Farm Products. — Reports and discussions. Alternate years, odd. Credit, 3
Professor Cance.

160. Elementary Principles of Statistics. — Chiefly related to Agriculture Lectures, laboratory studies, and original work. Taken in connection with Course 79. Fall term, yearly. Credit, 5
Professor Lindsey.

161. Advanced Statistics. — Winter term, yearly. Credit, 3
Professor Lindsey.

162. Agricultural Prices. — Spring term, yearly. Credit, 3
Professor Lindsey.

163. Specific Problems in Statistics of Agriculture. — Alternate years even. Credit, 3–5
Professor Lindsey.

165. Transportation of Agricultural Products. — Elementary discussion and report. Winter term, yearly. Credit, 5
Professor Cance.

166. Specific Transportation Problems. — Original study, reading, and report on certain transportation problems related to agriculture. Alternate years, odd. Credit, 3–5.
Professor Cance.

170. Co-operation in Agriculture. — Elementary problems and discussion. May be taken in connection with Course 52. Winter term, yearly. Credit, 5.
Professor Cance.

171–172. Special Problems in Co-operation for Economic Purposes. — Study, original investigation, and discussion. Every third year, beginning 1922. Credit, 3–5.
Professor Cance.

175. Agricultural Credit. — Readings and reports in addition to class lectures on agricultural credit. Taken in connection with Course 78. Spring term, yearly. Credit, 3–5.
Professor Lindsey.

185. Rural Law. — Corresponds to Course 75. Spring term, yearly.
Credit, 5.
Mr. Smart.

186. Studies in Agricultural Legislation. Credit, 3–5.
The Department.

190–195. Investigation of Various Problems related to Agricultural Economics. — Credit given on basis of time spent and reports submitted.

200. Thesis. — Research work in agricultural economics will be developed by four principal methods, namely, historical, statistical, accounting, and general field investigation. In all instances mastery of research methods includes facility in investigation, tabulation, and interpretation of results.

Minor Requirements.

Undergraduate prerequisites, 15 credit hours of economics and agricultural economics, including the following courses or their equivalents: Economics 25, Agricultural Economics 26 and 50.

Required work, Courses 111, 155, and 160, or equivalent courses.

Agricultural Education.

Major Requirements.

For the Degree of Master of Science.

Prerequisite Work. — A minimum of 25 undergraduate credits is required before beginning graduate study. These are to be the equivalents of Courses 51, 52, 55, 56, 75, and 80 as listed in this catalog, or permissible substitutes for them. Successful teaching experience will receive consideration.

Required Work. — A minimum of 50 credits, including the thesis, is to be earned from the following list of courses. A reasonable amount of graduate credit may be accepted from other institutions of good standing for partial satisfaction of the required total. In no case shall Courses 51 and 55 be taken by a graduate student for credit. The material of the other undergraduate courses may be used by special arrangement provided the work earns a grade of 85 or over and has not been taken before for credit.

Graduate Courses Offered.

100. History of Education — Ancient and Medieval. — The development of Education from the beginning of conscious educational practices to the close of the Middle Ages. Lectures, reading, reports, examination. Fall term.
Credit, 2–5.
Professor Glick.

102. History of Education — Modern. — A study of Educational theory and practice during modern times. Lectures, discussion, reading, reports, examination. Fall term. Credit, 2–5.
Professor Glick.

104. Vocational Education. — Laws, rulings, policies, and plans of Vocational Education in the United States. Lectures, reading, discussion, examination. Summer term. Credit, 5.
The Department and Vocational Division State Department of Education.

105. General Curriculum — Secondary Schools. — Principles and practices in curriculum determination. Lectures, reading, problem study, discussion, examination. Fall term. Credit, 5.
Professor Welles.

107. Special Curricula — Secondary Schools. — Studies of special type curricula in specific subjects. Lectures, reading, problem study, discussion, examination. Fall term. Credit, 2–5.
Professor Welles.

110. Rural Education. — May be general or special in character. Relates to aims, general character, curricula, and administration. Reading, problems, reports, examination. By arrangement. Credit, 2–5.
The Department.

115. Agricultural Teacher Training. — Has to do mostly with men in agricultural teaching service. Reading, conference, supervision of teaching. By arrangement. Credit, 3–5.
Professor Welles.

120. Intelligence and Aptitude Tests. — The theory and use of so-called intelligence tests and special aptitude tests. Lectures, discussions, reading, reports, laboratory work, examination. Spring term. Credit, 2–5.
Professor Glick.

122. Educational Tests. — The theory and use of standardized tests whose primary function is to measure school progress. Lectures, discussions, reading, reports, laboratory work, examination. Spring term. Credit, 2–5.
Professor Glick.

125. Senior High School: — Organization and Administration. — Lectures, reading, reports, examination. Winter term. Credit, 3.
Professor Welles.

127. Junior High School: — Organization and Administration. — Lectures, reading, reports, examination. Winter term. Credit, 3.
Professor Welles.

130. Advanced Educational Psychology. — This course affords opportunity for special study in any of the various phases of educational psychology. Lectures, reading, reports, experimentation, discussion, examination. Winter term. Credit, 2–10.
Professor Glick.

135. Educational Philosophy. — Primary consideration is given to the various aims of education both from the standpoint of theory and practice. Lectures, reading, reports, discussion, examination. Winter term. Credit, 2–10.
Professor Glick.

140. Educational Seminar. — Studies of educational problems and topics primarily by the thesis method. Conference and thesis. By arrangement. Credit, 2–10.
The Department.

145. Advanced Method Studies. — May be general methods or special methods in particular subjects. Reading, conference, reports, examination. Spring term. Credit, 5–10.
Professor Welles.

147. Supervised Teaching. — A limited opportunity for the graduate student to teach his regular classes under critical observation. Reading, teaching, discussion, lectures. By arrangement. Credit, 3.
Professor Welles.

200. Thesis. — Original work on an educational problem for new information or new applications of old information. Investigation, tabulation, and interpretation. Statistical methods for exactness wherever possible. Credit, 15–25.
The Department.

Minor Requirements.

Minor work is offered by the department for advanced degrees. Candidates must have had the equivalent of undergraduate Courses 51, 52, and 55 or permissible substitutes for them for a total of 15 credits as prerequisites.

Agronomy.

Major Requirements.

For the Degree of Doctor of Philosophy.

Prerequsite Work. — Candidates must have had the equivalent of undergraduate Courses 25 and 27 as described in this catalogue, and should have had thorough training in the elements of the natural sciences.

Required Work. — Studies will be assigned from the courses listed below. Thesis problems may be chosen in the subject matter of soils, fertilizers, or field crops.

The subject-matter content of the following courses is not fixed, but is determined in each individual case by the training, experience, and needs of the graduate student. This method permits a degree of flexibility which is conducive to the development of the individual capacity of the student.

For the Degree of Master of Science.

Prerequisite Work. — As above.

Required Work. — Assigned work will be selected from the courses listed below.

For the Degree of Master of Agriculture.

Prerequisite Work. — The same as for the degree of master of science in so far as it is essential to establish the professional approach to agronomy, but in addition the candidate must be familiar with agronomical practices.

Required Work. — As above.

Graduate Courses Offered.

110. Studies in the Culture of Field Crops. — Laboratory, field, or other problems concerning the tillage of field crops. Credit, 1–10.

115. The Fertilization of Field Crops. Credit, 1–10.

120. Studies in Harvesting and Storage. — Problems of method and time of harvesting and methods and conditions of storage, in relation to the keeping of field crops. Credit, 1–10.

125. The Improvement of Field Crops. — Readings, discussions, laboratory or field work in the improvement of field crops by breeding and selection. Credit, 1–10.

130. Technology of Field Crops. — The classification, grading, processing, and utilization of field crops. Credit, 1–10.

140. Soil Classification. — Laboratory, field, and library studies of methods and the principal groups, series, and types of soils. Credit, 1–10.

145. Studies in Soil Physics. — Problems concerning texture, structure, and other physical properties of soils. Credit, 1–10.

150. Moisture Relationships in Soils. — Readings and problems concerning the soil and moisture in their various relations. Credit, 1–10.

155. Studies in Soil Management. — Study of a wide range of problems arising in the management of soils for crop production. Credit, 1–10.

160. Soil Technology. — Includes studies of properties, behavior, and technical utilization of soils. Credit, 1–10.

165. Soil Reaction Studies. — Studies of hydrogen-ion concentration of soils as affected by natural agencies and conditions induced by practices of soil management. Credit, 1–10.

170. Studies of Soil Fertility. — Investigation of the factors and conditions affecting the productivity of soils. Credit, 1–10.

175. Organic Matter of the Soil. — Includes studies of the origin, properties, and methods of maintenance of soil organic matter, and its physical and biochemical relations to soil fertility. Credit, 1–10.

180. Fertilizer Technology. — Studies of the properties and behavior of fertilizer materials when unmixed with the soil. Credit, 1–10.

185. Fertilizers and the Soil. — Concerning the interrelationships of soils and fertilizers when mixed. Credit, 1–10.

190. Studies in Literature. — Practice in preparing abstracts and summaries of the literature bearing on selected topics. Credit, 1–10.

200. Thesis. Credit, 15–50.

Minor Requirements.

Prerequisites are as stated for major work. In addition studies suited to the needs of the candidate will be selected from the above courses.

Animal Husbandry.

Major Requirements.

For the Degree of Master of Science or Master of Agriculture.

Prerequisite Work. — Candidate must have had the following courses, or their equivalents, before he can enter graduate work in this department: Animal Husbandry 25, 26, 50, 52, 53, and 75. He should also be able to show evidence of experience in practical animal husbandry.

Required Work. — At least 50 credits must be earned from the following list of courses offered by the department.

Graduate Courses Offered.

100. Advanced Breed History. — Special study of the genetic and historical foundations of any modern breed of livestock and its developmental trends, accomplishments, and present status. Credit, 10.

110. Nutrition of Farm Animals. — An advanced course dealing with the nutritional physiology of animals and the chemistry of metabolism. Special emphasis is laid upon the role of proteins, minerals, and vitamines in the efficient production of animal products. Credit, 10.

120. Breeding of Farm Animals. — An advanced course dealing with the physiology of reproduction in domestic animals and with the laws of inheritance as evidenced through the various systems of breeding. The working of Mendelian principles in domestic animals is carefully considered. Credit, 10.

200. Thesis. — Research work in Animal Husbandry may consist of historical studies of the modern breeds of livestock, experimental studies in animal nutrition or breeding. Credit, 25.

Minor Requirements.

Minor work in animal husbandry may include undergraduate Courses 50, 53, 81, and such work in reading and compilation of material as the instructor may

outline. Written examinations will be conducted at the completion of each term's work.

Bacteriology and Physiology.

Major Requirements.

For the Degree of Doctor of Philosophy.

Prerequisite Work. — Candidate must have had Courses 50, 51, 80, 81, and 82, or their equivalents, and Chemistry 51, 52, 53, or their equivalents, before he can enter upon graduate work.

Required Work. — Studies will be selected from the courses offered below. It will be the purpose of the department to distribute such studies among the courses offered in a manner to gain the greatest efficiency and a comprehensive knowledge of the entire field. The work will be conducted by prescribed readings, conferences, lectures, and laboratory exercises.

For the Degree of Master of Science.

Prerequisite Work. — The same as for the degree of doctor of philosophy.

Required Work. — Courses of a basic and applied character selected from the courses offered below which will prepare the student for effective effort.

Graduate Courses Offered.

100. History of Bacteriology. — Studies in the development of bacteriology from the late seventeenth century to the present time, especially planned to show the developments of bacteriology in relation to agriculture, public health, the arts, industry, and medicine. Credit, 1–5.

110. Physiological Studies on Bacterial Metabolism. — The study of physiological oxidations, biochemical changes, nitrification, ammonification, and biophysical phenomena associated with the functions of bacterial physiology. Credit, 5–20.

120. Agricultural Bacteriology. — Special lectures on bacteriology in relation to agricultural procedures. Open only to students well prepared in chemistry, soil, water, food, and dairy bacteriology, and having had Bacteriology 75 or its equivalent. Credit, 5–20.

130. Soil Bacteriology. — Accurate applications of microchemical methods are demonstrated. Biochemical and biophysical methods for measuring the physiological activities of soil microorganisms are studied. Nitrification, denitrification, and ammonification will be discussed in relation to their influence on soil fertility. Credit, 5–20.

140. Dairy Bacteriology. — Technical procedures used in establishing sanitation in relation to milk production and supply will be discussed. Modern methods involved in the preparation, control, and preservation of milk and dairy products are studied. Credit, 5–20.

150. Food Bacteriology. — Principles of food preservation and conservation; the application of scientific methods to the understanding of food fermentations and spoilage will be considered. This is arranged primarily for students with an excellent background in both chemistry and bacteriology. Credit, 5–20.

160. Hygienic Bacteriology. — Special consideration given to organization of disease control campaigns, laboratory management, the relationship of serology, immunology, and bacteriology to municipal, rural, and community health. Bacteriological, immunological, and serological procedures will be presented, and there will be discussion of problems showing their use for improving the condition and environment for human and animal life. Credit, 5–20.

170. Physiology, Human or Animal. — Given only to students who have had undergraduate Courses 63, 64, and 65, or their equivalents. Study of the physiology of the circulation with special reference to intermediate metabolism; to be followed by a course on the physiology of excretion. This course in physiology may be considered from the standpoint of human or animal physiology, according as the student may elect. Credit, 5–10.

190. Lectures and Study of Literature. Credit, 1 each term.

200. Thesis. — Some microbiological problem related to agriculture, food, or public health. Distributed as may be most beneficial for research work. Time and credit by arrangement. Credit, 15–50.

Minor Requirements.

Minor work in bacteriology may consist of undergraduate Courses 50, 51, 75, 80, 81, and 82 and other courses designed to support the major work, from among the courses offered above. The candidate will also be required to pursue graduate Course 190, or follow a course of reading and conferences through three terms. In case the candidate has had some of these courses, he will be required to take more advanced substitute courses.

Botany.

Major Requirements.

For the Degree of Doctor of Philosophy.

Prerequisite Work. — The equivalent of certain undergraduate courses, determined by the department in the case of each student, is prerequisite.

Required Work. — Candidates will be required to take Courses 100 through 107, and 180, 190, and 200. Courses 150 through 155 may be taken for graduate credit in certain cases. The maximum number of major credits which may be earned in this way is 29.

For the Degree of Master of Science.

Prerequisite Work. — The requirements are the same as for the degree of doctor of philosophy.

Required Work. — Candidates will take Courses 100 and 101, and all courses from 102 through 107 which are given during their term of residence, also 180, 190, and 200. In certain cases Courses 150 through 155 may be taken, but not more than 20 credits may be earned in this way.

Graduate Courses Offered.

Courses 100 through 106 are lecture courses. They are given in rotation, except Courses 100 and 101, which come every year.

100. Plant Physiology. — The lectures will consider, under the nutrition of the plant: its chemical structure, absorption of various nutrient substances and their changes in the plant, assimilation and dissimilation of carbon and nitrogen by autotrophic and heterotrophic plants; under changes in the form of plants: growth and form under constant external factors, the influence of variable external and inner factors on growth, form, and development; and under plant movements: the various tropisms, mutations, etc. Supplemental demonstrations, laboratory work, and readings in the standard texts and journals. One lecture a week for 36 weeks. Credit, 3.

101. Plant Pathology. — A general consideration of the history, nature, and causes of plant disease; parasitism, predisposition, immunity, degeneration, natural and artificial infection, dissemination, epidemics, biologic strains, monstrosities and malformations, proliferation, prevention and control, economics of plant diseases. One lecture a week for 36 weeks. Credit, 3.

102. Plant Inheritance. — This course is planned to give the student a comprehensive understanding of the principles and facts of plant inheritance. A study is made of plant variations, Mendel's law of heredity, the physical basis of heredity as established by chromosome behavior, pure lines, mutations, species and graft hybrids, etc. One lecture a week for 12 weeks. Credit, 1.

103. Biologic Relations. — Consideration of certain phases of the morphological and physiological adaptations of plants with regard to insect visits; the role of thorns, hairs, tendrils, glands, etc. Various experiments are made to test out experimentally some of the existing theories concerning biologic adaptations. One lecture a week for 12 weeks. Credit, 1.

104. The Ecology of Plants. — This course deals with the water, light, and temperature relations of plants, and the various adaptations in response to these factors; the various types of plant formation; the migration of plants; the competition of plants; invasion and successions of plants under varied conditions; and the various types of alternations and zonations. One lecture a week for 12 weeks. Credit, 1.

105. Physiological Plant Pathology. — This course considers those plant diseases not due to bacterial or fungous parasites, but resulting from unfavorable physical or chemical conditions of the soil; from harmful atmospheric influences, such as too dry air, too much moisture, hail, wind, lightning, frost; from injurious gases and liquids; from lack of or too much light; from wounds. A knowledge of the normal physiology of the plant is required. Demonstrations and laboratory work will be given, together with assigned readings. One lecture a week for 12 weeks. Credit, 1.

106. History of Botany. — An historical survey of the science; lives of noted botanists; history of certain culture plants, such as wheat, corn, coffee, potato, rice, and their influence on civilization; reading. One lecture a week for 24 weeks. Credit, 2.

107. Methods in Drawing and Photographing for Thesis and Publication. — Twelve weeks. Credit, 1–3.

108. The Comparative Anatomy of Green Plants. — See undergraduate Courses 61–63.

109. Systematic Botany of the Higher Plants. — See undergraduate Courses 58, 59, and 60.

150. Systematic Mycology. — See undergraduate Courses 52–53.

152. Plant Histology. — See undergraduate Course 55.

154. Plant Pathology. — See undergraduate Courses 75–77.

155. Plant Physiology. — See undergraduate Courses 78–80.

156. Plant Ecology. — See undergraduate Course 81.

180. Seminar. — A weekly seminar for members of the department staff, graduate students, and major senior students is held, at which important botanical papers are discussed. Attendance and participation are required. Credit, 3.

190. Collateral Reading. — Extensive reading of botanical literature in English, German, and French, designed to give the student a broad knowledge of the science is required of all major students. Final examinations are based in part upon this reading course. Credit, 5–10.

200. Thesis. — Each major student is required to select a problem in plant pathology or physiology (in other branches at the discretion of the department)

for original investigation, and the thesis must embody a distinct contribution to knowledge. An effort will be made to assign problems having some bearing on scientific and economic agriculture. The thesis work counts for not more than 50 per cent of the total number of major credits required for either degree.

Minor Requirements.

For a minor a student may take such of the work offered by the department as seems best suited to his major course. Courses 150 and 155 are primarily undergraduate work which may be taken for minor credit toward advanced degrees. In most cases no problem will be assigned.

Professors Osmun, Clark, Torrey, Doran, and Davis.

Chemistry.

Major Requirements.

For the Degree of Doctor of Philosophy.

Prerequisite Work. — The candidate must have taken undergraduate Courses 1 to 87, or their equivalent.

Required Work. — The candidate will be required to take all the graduate courses listed below. He may also be required to spend at least one year at some other recognized institution, pursuing graduate study in chemistry. For the final examinations, questions will be selected from the entire field of chemistry, with special emphasis upon the lines of work covered by the research.

For the Degree of Master of Science.

Prerequisite Work. — Courses 1 to 63 required; 75 and 80 desirable.

Required Work. — Courses 101, 109, 110, 111, 112, 114; and 6 to 11 credits, according to the nature of the work, from Courses 102, 103, 104, 105, 106, except that if the candidate has not had Courses 75, 80, 86, and 87 these must be taken, and may be substituted for some of the Courses 102 to 106. The candidate must pass a final written and oral examination before the department upon undergraduate Courses 1 through 80, as well as upon all graduate work taken in chemistry.

Graduate Courses Offered.

101. Inorganic Preparations. — Laboratory. The preparation of chemical products from raw materials. The manufacture and testing of pure chemicals. The laboratory work is essentially synthetic in nature, and is designed to aid in acquiring a more adequate knowledge of inorganic chemistry than is to be obtained by chemical analysis alone. Any term. Credit, 3 or 5.

Assistant Professor Serex.

102. Advanced Inorganic Preparations. — Laboratory. Continuation of Course 101. Any term. Credit, 3 or 5.

Assistant Professor Serex.

103. Advanced Analytical Chemistry. — Laboratory. This course may be taken in part as follows: (a) electrolytic analysis, 6 credits; (b) ultimate analysis, 3 credits; (c) special analytical work to meet the needs of the individual student, 5 credits. In addition the following subjects may be taken, if desired: (d) fertilizers, 5 credits; (e) insecticides, 3 credits; (f) milk and butter, 5 credits. (a), (b), (c) may be taken any time; (d), (e), (f) should be taken at the time the undergraduate course is given.

Professor Peters.

104. Advanced Physical Chemistry. — Laboratory. Measurement of the electrical conductivity of solutions; degree of ionization; ionization constants; per cent hydrolysis of aniline hydrochloride from conductivity measurements;

solubility product by the conductivity method; velocity of saponification by conductivity; neutralization point by conductivity; vapor pressure determinations; critical temperature of carbon dioxide or sulphur dioxide; transport numbers; preparation and properties of colloidal solutions; transition points by dilatometric method; heat of solution of ammonium chloride and potassium nitrate; adsorption of iodine by charcoal; determination of hydrogen ion concentration. To each student separate work will be assigned. Any term. Credit, 5.

Assistant Professor Serex.

105. Advanced Organic Chemistry. — Laboratory. The preparation of compounds not included in Courses 51, 52, 53, such as the Kolbe synthesis of salicylic acid; benzophenone and Beckmann's rearrangement; rosaniline, malachite green, Congo red, indigo, and other dyes; synthesis of fructose; Grignard reaction. To each student separate work will be assigned. Any term. Credit, 5.

Professor Chamberlain.

106. Advanced Physiological and Food Chemistry. — Laboratory. An intensive study of some of the more important physiological processes, physiological compounds, or food ingredients. Studies of milk, blood, urine, or other physiological factors under various metabolic and pathologic conditions. To each student separate work will be assigned. Any term. Credit, 5. Prerequisite, Chemistry 80.

Mr. Cupery.

109. Theoretical or Analytical Chemistry. — Lectures. A study of the development of the electron conception of valence; the structure and size and compressibility of atoms. A general survey of the analytical processes and the theory underlying. Third term. Subjects alternate annually. Credit, 1.

Professor Peters.

110. Organic Chemistry. — Lectures. Some of the following topics will be considered both theoretically and industrially: alkaloids, synthetic dyes, essential oils, terpenes, rubber, cellulose; the study of methods for carrying out general reactions; isomerism, tautomerism, condensation, etc. First term. Subjects alternate annually. Credit, 1.

Professor Chamberlain.

111. Advanced Physiological and Food Chemistry. — Lectures. A study of the recent advances in this field. An intimate treatment of the more important physiological factors and their relations to health, nutrition, and growth. Second term. Subjects alternate annually. Credit, 1.

Mr. Cupery.

112. Theoretical and Physical Chemistry. — Lectures. A general outline of special topics selected from recent publications covering theoretical and physical chemistry. Third term. Subjects alternate annually. Credit, 1.

Assistant Professor Serex.

114. Seminar. — Conferences, reports, or lectures. Each term, once a week. Credit, 1.

Professor Lindsey.

200. Thesis. — Research, and, in the case of a degree, the preparation of an acceptable thesis in agricultural, analytical, organic, physiological, or physical chemistry, under the direction of the professor in charge of the work. Credit determined by work done.

Minor Requirements.

Work may be selected from any of the undergraduate Courses 51 to 87, or any of the graduate courses for which the student is prepared. In addition, the candidate may be required to pass a final written and oral examination before the department upon his entire minor work.

Dairy Husbandry.

Major Requirements.

For the Degree of Master of Science.

Prerequisite Work. — Undergraduate courses: Physics 25, 26, and 27; Bacteriology 50, 51, and 80; Chemistry 30 and 81, and prerequisite work; Dairy 50, 51, 52, 75, 76, 77, 78, 79, and 80 will be required for graduate work, and any student who has not passed these courses or their equivalent will be required to make up such work without graduate credit.

Required Work. — Studies will be assigned from courses listed below or from correlated work in other departments.

Graduate Courses Offered.

101. History and Development of Dairying. — A review of the early history of dairying and factors in the industry contributing to its present development. Credit, 3–10.

102. Ice Cream Problems. — A study of existing scientific, technical, and marketing problems in the field of ice-cream making. Credit, 2–10.

103. Market Milk Problems. — Consideration of production, processing, and distribution of milk, the nutritional value of milk, chemical and bacteriological aspects of milk handling. Credit, 2–10.

104. Surplus Milk Problems. — The economical disposal of seasonal surpluses through cheeses, butter, milk drinks, etc. Credit, 2–10.

105. Dairy Plant Management. — The selection, construction, and arrangement of dairies and dairy machinery, and economical operation of same. Credit, 2–10.

195. Seminar. Credit, 1–2.

200. Thesis. — Original research work having a bearing on some important problem in dairying. Credit, 15–25.

Minor Requirements.

Minor work in Dairy Husbandry may include undergradute Courses 52, 75, 76, 78, and such other work as the instructor may outline. Written examinations are required at the completion of each term's work.

Entomology.

Major Requirements.

For the Degree of Doctor of Philosophy.

Prerequisite Work. — The candidate must have taken undergraduate Courses 26, 28, 52, 53, 55, 57, 75, 76, 77, 78, and 79 or their equivalent. Opportunities to make up any deficiencies will be available while the graduate work is being carried on.

Required Work. — Courses from the list below, consisting of lectures, laboratory work, advanced readings, seminar, and thesis.

For the Degree of Master of Science.

Prerequisite Work. — The same as for the degree of doctor of philosophy.

Required Work. — A major course for the master of science degree will consist of subjects from the list below selected as far as possible to meet any special needs of the candidate, and will be about half of the work required for the doctor of philosophy degree.

Graduate Courses Offered.

As these courses vary from a few exercises only to half a year or more, no fixed number of credits can be assigned to them.

Morphology. — 101–120.

101. Embryonic development of insects and polyembryony.
Professor Crampton.

102. Metamorphosis and its interpretations.
Professor Crampton.

103. Advanced external and internal anatomy.
Professor Crampton.

104. Insect histology and physiology.
Professor Fernald.

105. Ancestry and development of insects, including fossil forms.
Professor Crampton.

106. Hermaphroditism in insects.
Assistant Professor Alexander.

107. Hybrids.
Professor Fernald.

108. Parthenogenesis, pedogenesis, and heterogeny.
Professor Crampton.

109. Chemistry and physics of insect colors.
Professor Fernald.

110. Color patterns, their significance and value.
Professor Fernald.

111. Luminosity.
Professor Fernald.

112. Insect teratology.
Assistant Professor Alexander.

113. Variation in insects.
Assistant Professor Alexander.

Ecology. — 121–140.

121. Dimorphism and polymorphism.
Assistant Professor Alexander.

122. Mimicry, including concealment, protective devices, and warning coloration.
Professor Crampton.

123. Architecture of insect structures.
Professor Fernald.

124. Relation of insects to plant fertilization and its importance.
Professor Fernald.

125. Insect products of value to man.
Professor Fernald.

126. Geographic distribution and methods of distribution of insects, with consideration of life zones, barriers, etc.
Assistant Professor Alexander.

127. Insect migrations.
Assistant Professor Alexander.

128. Insect behavior and experimental entomology.
Professor Crampton.

129. Enemies of insects.
Professor Fernald.

130. Duration of life.
Professor Fernald.

Economic Entomology. — 141–160.

141. Control methods.
Professor Fernald.

142. Insect photography and methods of preparing illustrations.
Professor Fernald.

143. Field work and life history investigations, with methods for keeping records. Professor Fernald.

144. Legislation about insects.
Professor Fernald.

145. Studies of insecticides and their application.
Professor Fernald.

146. Insectary methods.
The Department.

147. Biological control of insects.
The Department.

Systematic Entomology. — 161–179.

161. History of entomology and of classifications.
Professor Fernald.

162. Lives and works of prominent entomologists.
Professor Fernald.

163. Abundance of insects.
Professor Fernald.

164. Important collections, public and private; their location and their value.
Professor Fernald.

165. Types of insects; their significance, importance, and location.
Professor Fernald.

166. Rules of nomenclature and how they are used.
Assistant Professor Alexander.

167. Methods for collecting, preparing, preserving, and shipping insects.
The Department.

180. Seminar. — Reports on the current literature of entomology; special reports; monthly meetings.

190. Advanced and Collateral Readings. — The best articles on various topics in entomology are assigned for study, and the subjects are included in the final examinations.

200. Thesis. — Original research on one or several topics in morphology, ecology, economic and systematic entomology. This may require from one-half to two-thirds of the total working time of the student.

Minor Requirements.

Minor courses will cover such parts of the work outlined above as will be most likely to prove useful in connection with the majors taken by the students, or in their future work. It is not required that such men shall have had all the undergraduate work in entomology given at this college, their credit for a minor beginning where their own undergraduate training in the subject ended.

Horticulture.

Graduate work is offered in various lines of horticulture. For the most part this is divided into the different departments which constitute the college Division of Horticulture, as follows: pomology, floriculture, landscape gardening, forestry, and market gardening. For work in these lines application should be made direct to the heads of the several departments.

Besides this work, however, opportunity is offered for graduate study in general horticulture, including topics from the several organized departments men-

tioned, and also questions relating to plant breeding, general evolution, propagation, manufacture of horticultural products, etc. This general work is under the direction of Professor Waugh, head of the Division of Horticulture.

Landscape Architecture.

Major Requirements.

For the Degree of Master of Landscape Architecture.

Prerequisite Work. — 1. The undergraduate courses in the college known as Landscape Gardening 50, 51, and 52; Drawing 25, 26, and 27; Horticulture 50 and 51, and Mathematics 26 and 27 will be considered prerequisite, and any student who has not passed these courses, or their equivalent, will be required to make up such work without graduate credit.

2. Each student before he may receive the master's degree with a major in this department must convince his instructors that he has a genuine aptitude for some branch of landscape architecture, either in design, construction, or management.

3. The minimum period of graduate study will be one and one-half years. At least one year of this time must be spent in residence at the college. One year must also be spent in practice outside of the college. The work done outside the college may be prescribed by the department, and must be fully reported to the department in writing. It is essential, further, that the candidate secure the written approval of his employers outside the college. The department may, at its discretion, require a longer period of study at the college or a longer apprenticeship outside the college.

4. Every student before receiving his master's degree in landscape architecture must have given some thorough and fruitful study to each of the principal branches of the subject, *viz.*, theory, design, architecture, construction, maintenance, and office practice. As far as possible these studies will be of a practical nature, that is, they must be made upon going projects.

5. While great freedom is allowed to graduate students in their plans of work, a certain portion of time will always be given to systematic courses in instruction. Courses known as Landscape Gardening 75, 76, 78, 79, 81, and 82 are required, and may or may not be accepted for graduate credit, at the discretion of the department.

Graduate Courses Offered.

190. Theory. — Special studies in the history and theory of art and of landscape architecture. Credit, 2–10.
The Department.

191. Design. — Individual problems in any or all branches of design, including estates, parks, playgrounds, public grounds, etc. Credit, 2–10.
The Department.

192. Construction. — Individual problems by arrangement, including engineering, estimating, cost accounting, and methods of construction.
Credit, 2–10.
The Department.

193. Maintenance. — Special studies, experimental work of assigned problems in various forms of grounds maintenance, costs, and methods. Credit, 2–10.
The Department.

194. Practice. — Professional field work under supervision, conducted upon going projects as opportunity offers. By arrangement. Credit, 2–10.
The Department.

195. Seminar. — Regular meetings for conference. Credit, 1–5.
Professor Waugh.

200. Thesis. — Each student before receiving the master's degree with a major in landscape architecture must present a satisfactory thesis or complete project. A thesis will consist of a careful original study of some problem in landscape architecture, presented in typewritten form with any necessary illustrations, such as photographs, diagrams, drawings, etc. A project will consist of a completed set of studies of some suitable landscape-gardening problem, such as the design of a park, a real estate subdivision, an extensive playground. Such a project will usually consist of —

(*a*) Original surveys, including topography.
(*b*) Block plans, showing original design.
(*c*) A rendered plan or plans of the main features.
(*d*) Detailed working drawings.
(*e*) Estimates of cost.
(*f*) Complete report and letter of transmittal.

Credit, 5–20.

Minor Requirements.

Any student electing a minor in landscape architecture will be directed to take such courses from the regular catalogue list as may seem most suitable to him. Under ordinary circumstances no other work will be given to students electing minors. In special cases, however, individual problems will be assigned and individual instruction given. These exceptions will be made in cases where by so doing, it is possible to give the student material assistance in the plan of his major work.

Mathematics and Physics.

No regularly outlined major in mathematics and physics is offered at present but such a course may be arranged for individual students. As a minor, work in these subjects is available and would be selected in the lines most needed by the student in connection with his major in each case.

The requirement of 25 credits for a minor may be taken in either subject or divided between them.

Pomology.

Major Requirements.

For the Degree of Doctor of Philosophy.

Prerequisite Work. — Candidates must have had the equivalent of the courses required for graduation from this college; also sufficient practical experience to enable them to understand and appreciate the problems of orchard practice.

Required Work. — The work outlined below will be required of all candidates.

For the Degree of Master of Science.

Prerequisite Work. — The same as for the degree of doctor of philosophy.

Required Work. — One-half of the work outlined below, selected to meet the needs of the individual student, will be required.

Graduate Courses Offered.

101. Experimental Methods. Credit, 15–20.

A critical study of the methods of research that have been used or may be helpful in pomological work. The following topics will be considered from the point of view of the investigator in pomology.

1. Statistical methods.
2. Measures of growth and yield.
3. The conduct of plot experiments.
4. Methods of soil study in their relation to pomological research.
5. Chemical methods of pomological research.
6. Methods of physiology applicable to fruit plants.
7. Microchemistry.

102. Pomological Research. Credit, 15–20.
A critical survey of past and current research work in pomology. Semi-weekly meetings for reports and discussions will be held. The following topics will be taken up:

1. Orchard soil management.
2. Soil fertility and fertilizers.
3. Physiology of pruning tree fruits and bush and vine fruits.
4. Fruit bud differentiation.
5. Sterility and fertility.
6. Genetics of fruit plants.
7. Climatology and winter injury.
8. Advanced morphology.
9. Spraying machinery and equipment.
10. Special practices.

103. Advanced Laboratory Work. Credit, 5–12.
Each student will be required to become familiar with the research work of the department and to have a share in it. So far as this has value as graduate work, he will receive credit.

104. History of Pomology. Credit, 2–5.
The men, institutions, and other influences that have contributed to the development of the science and art of pomology.

105. Horticultural Taxonomy. Credit, 2–3.
A study of the history and development of plant classification with special reference to horticultural plants. A study of modern classification carries with it an expression of opinion as to the evolution of cultivated plants.

106. Advanced Systematic Pomology. Credit, 6–10.
The principles of systematic pomology including a study of nut and subtropical fruits not usually dealt with in undergraduate courses. Opportunity is also offered for study of leaf and general tree characters of nursery and orchard trees and the relationship of varieties as indicated by these characters as well as those of the fruit.

200. Thesis. Credit, 40–50.
Each student will be required to carry out an original investigation of an assigned problem. In planning, executing, and interpreting the data of this problem he must show marked ability. The results are embodied in a thesis to be passed upon by the Department and the Graduate Staff.

Minor Requirements.

Students taking a minor in pomology will select such of the above courses as may be suited to their needs. Certain advanced undergraduate courses may also be taken for minor credit.

Poultry Science.

Major Requirements.

For the Degree of Master of Science or Master of Agriculture.

Prerequisite Work. — The postgraduate course presupposes all undergraduate work or its equivalent, together with practical experience. Without the latter, students will be unable to handle Courses 140, 150, and 160. At the discretion of the instructor in charge, graduate students may be required to pursue undergraduate courses in other departments without credit.

Required Work. — All the courses listed below. Practical poultry work may be required, but no credit will be given for such work.

Graduate Courses Offered.

101. Science of Poultry Husbandry. — A review of the entire field of poultry literature, including books, bulletins, journals, and other special articles. A written report on one or more subjects is required.

110. Poultry Problems and Literature. — A critical review and a criticism of the more important experiments carried on at various stations in this and other countries; also a study of poultry conditions in foreign countries, methods of management, etc., besides a detailed study of some of the largest poultry projects in this country.

120. Anatomy (Gross and Histological), Physiology, and Surgery. — This course requires a careful study of the anatomy and physiology of the fowl. Special attention is given to a study of those structures concerned with practical poultry problems. Instruction in surgical technique, adapted to fowls, may also be given.

130. Breeding. — The student will carry on such breeding experiments as time and facilities permit. He may also do work in connection with our regular experimental projects. A detailed study of the pertinent literature will be required. Animal Husbandry 53, or its equivalent, is a prerequisite.

140. Feeding and Nutrition. — A study of the relation of various feeds to the morphology and physiology of the fowl. Special attention is given to the effects of various nutrients on growth, sexual maturity, egg production, character of plumage, and condition of flesh. Complete rations as well as methods of feeding are fully considered.

150. Brooding. — Studies will be made upon the relation between viability and rate of growth and the following topics: type of brooder, number of chicks in brood, ventilation, humidity, sanitation, exercise, and weather conditions; also a comparison of natural methods with artificial methods of rearing chicks.

160. Incubation and Embryology. — A number of problems of a practical, scientific, and mechanical nature relating to incubation are considered. The work in embryology is of an advanced nature, dealing with its relation to morphogenesis and heredity, and presupposes an elementary knowledge of the embryology of the chick.

170. Poultry Diseases and Sanitation. — In this course a study is made of various problems in poultry sanitation, with particular reference to methods relating to the control and eradication of disease.

200. Thesis. — Research work may be carried out in the following lines: breeding, nutrition, brooding and incubation, and embryology. Originality and thoroughness are particularly emphasized.

Minor Requirements.

Courses 101 and 110 are designed particularly for minors.

Rural Sociology.

Major Requirements.

For the Degree of Doctor of Philosophy.

Prerequisite Work. — Candidates must take, or pass by satisfactory examination, the following courses: Sociology 27, 50, 51, 52, 54, and 75.

Required Work. — Candidates will be required to select from the courses listed below as graduate courses a field for investigation and intensive study. Candidates for the doctorate must take all courses listed as graduate.

For the Degree of Master of Science.

Prerequisite Work. — The same as for the degree of doctor of philosophy.
Required Work. — Not less than 50 credit hours will be required from the courses listed below. The department will make such selection as may best meet the interest of the individual student.

Graduate Courses Offered.

177. Field Work of an Investigational Nature. — Research methods employed by sociologists — measurements, exploration, criticism, surveys; scientific value of the representative sample; quantitative measurements versus observation, comparison, and correlation; scholarly application of research methods by members of the class. Credit, 3.
Assistant Professor Cutler.

178. Social Surveys. — The social survey in actual practice; the bird's-eye view; the segmental survey; reporting and publishing the findings.
Credit, 3.
Assistant Professor Cutler.

179–181. Seminar. — The seminar described under Sociology 79, 80, and 81. Graduate students render reports on research in which they engage, and upon selected portions of current literature. The reports serve as the basis for general discussion. Credit, 2.
Professors Mackimmie and Cutler.

182. Social Conditions of American Rural Life. — Social and economic factors in rural progress; farm income and farm life. Credit, 2.
Assistant Professor Cutler.

183. Social Conditions of Old World Rural Life. — A sociological investigation of rural life in Europe, the Orient, and the Far East; rural co-operative enterprise in Denmark; agriculture in China after one hundred twenty generations. Credit, 2.
Assistant Professor Cutler.

186. Farmers' Organizations. — A study of social and economic co-operation. Credit, 2.
Assistant Professor Cutler.

187. Town and Village Rural Life. — The agricultural village; the small town in relationship to its environing neighborhoods. Credit, 2.
Assistant Professor Cutler.

190. Rural Government. — Proposed improvements in rural local government. Credit, 2.
Assistant Professor Cutler.

191. Rural Leadership. — Qualities and methods making for successful leadership in rural communities. Credit, 2.
Assistant Professor Cutler.

192. Rural Conditions in the Caribbean Region. — A sociological study of rural life and industry in the American possessions and protectorates; relation of the West Indies to the United States. Credit, 2.
Assistant Professor Cutler.

193. The League of Nations and Agriculture. — Agricultural problems in their international aspects. Credit, 2.
Assistant Professor Cutler.

200. Thesis. — Upon an approved subject, and must be a valuable contribution to knowledge. Especial stress is laid upon the feature of originality in the case of candidates for the doctorate.
Credit, for master's degree, 25; for doctor's degree, 50.

Veterinary Science.

Animal Pathology.

A minor consisting of two graduate courses (10 credits) in animal pathology, together with undergraduate courses (15 credits) in veterinary science, or bacteriology and physiology (see pages 66–68) is offered by this department.

120. General Pathology. — Arranged to meet the need of graduate students who have not pursued a course in general pathology. Reviews in gross and microscopic animal anatomy, followed by demonstrations and discussions on morbid anatomical phases of pathology (pathological histology). A written examination will be given at the end of the term. Winter term. Credit, 5.

140. Laboratory Methods of Diagnosis in Veterinary Science. — This course will consider bacteriological, biochemical, and serological methods now used as aids in animal pathology and in the diagnosis of animal diseases. Especial emphasis will be placed upon laboratory management, interpretation and classification of laboratory data, and the relationship of laboratory work to epizoötics, epidemics, and the public health. A written examination will be given at the end of the term. Spring term. Credit, 5.

Zoology and Geology.

Courses in zoölogy and geology may be available in connection with the fulfillment of requirements in a minor for an advanced degree. The nature of the work will vary according to circumstances, and may be intensive in a special field or of somewhat general character, depending upon the student's needs and his knowledge of either one of the subjects herein offered, in which he may wish to study further.

The Summer School.

The summer session offers courses of collegiate grade only. Both undergraduate and graduate courses are given, intended for school superintendents, normal school, high school, college, and university teachers, college undergraduates, and any other serious student who is suitably prepared. When satisfactorily completed, these courses carry collegiate credit.

Admission.

There are no formal examinations for admission to the summer school. Undergraduate students are admitted to such courses as their preparation justifies. Admission to the graduate school will be granted to graduates of the Massachusetts Agricultural College and to the graduates of other institutions having substantially equivalent requirements for the bachelor's degree.

The following schedule of courses, given in the summer of 1929, indicates the character and extent of the work, but is subject to modification.

Education:
- Principles and Methods of Teaching.
- History of Philosophy and Practice in Education.
- Educational Psychology.
- Secondary Education.
- Special Methods in Teaching Vocational Agriculture.
- Tests and Measurements.
- The Employed Teacher of Agriculture.
- Vocational Education.

Horticulture:
- Plant Materials.
- Garden Flowers and Bedding Plants.

Science:
- College Algebra.
- Advanced Entomology.
- Fresh Water Algae, Fungi, Liverworts, Mosses, and Ferns.
- Public Health.
- Physiological Chemistry.

Home Economics:
- Clothing.
- Child Care and Training.
- Home Management Problems.
- Teaching Home Economics.

Literature:
- American Literature.
- Dramatic Presentation.
- Ibsen and the Contemporary Drama.

Fees.

The tuition fee for undergraduate work in the summer session is ten dollars together with a recreation fee of two dollars, and laboratory fees in certain courses.

For further information, write or apply to Roland H. Verbeck, Director of Short Courses, Massachusetts Agricultural College, Amherst, Mass.

For information concerning graduate work in the summer school, write or apply to Henry T. Fernald, Director of the Graduate School, Massachusetts Agricultural College, Amherst, Mass.

Non-Degree Courses of Instruction.

THE STOCKBRIDGE SCHOOL OF AGRICULTURE.

General Information.

Under the name of "The Two-year Course in Practical Agriculture," this school was organized in 1918 at the request of the Massachusetts Legislature, to meet the demand for a short course in agriculture which might be taken by students who either could not satisfy college entrance requirements or who, for one reason or another, were unable to take the collegiate course. Since its organization the School has registered over 1,300 students and now has over 500 graduates located largely in Massachusetts, although they are also to be found throughout New England and even in Florida, California, and many other states of the Union. More than 240 students were registered in the School during the year 1928–29.

In May, 1928, by vote of the trustees of the College, the name of the course was changed to "The Stockbridge School of Agriculture." It is expected that the new name will more clearly indicate the distinction between the degree and non-degree courses offered at the Massachusetts Agricultural College and correct the impression that students who take this course have completed two years of collegiate work. Graduation from the Stockbridge School of Agriculture does not satisfy the entrance requirements of the College, and Stockbridge School of Agriculture credits are not accepted by the College as equivalents of any part of the requirements for the B.S. degree.

As the course is now organized, students may specialize in any one of seven vocations: animal husbandry, dairy manufactures, flower growing, horticulture, fruit growing, poultry raising, or vegetable gardening. Specialization in a vocation does not prevent students from securing a general working knowledge of other subjects. The Stockbridge School will appeal not only to young men and women, but also to men and women of mature years and practical experience who wish to know more about the business of farming or associated agricultural industries. The School is not intended for students enrolled in a high school; such students should complete their high-school course before seeking admission to this school.

Entrance Requirements.

Applicants for admission must be at least seventeen years of age and must have completed at least an elementary school course or its equivalent. Before being enrolled for the work of the second year, students must have completed six months' practical experience approved by the supervisor of placement training.

Students who are already enrolled in high schools and who wish to enter this school before the completion of the high-school course should bring a statement, either from the principal of the high school or from the parent or guardian, requesting enrolment.

Instruction.

The instruction is given by the regular faculty by means of classroom teaching, laboratory exercises, and practical work. The work of the classroom is supplemented by demonstration work in the laboratory, dairy room, greenhouse, and stables, and by a six months' period of farm placement training during the spring and summer following the second term of resident instruction. The course is designed to offer plain, practical, direct information, and to establish the underlying reasons for, as well as methods employed in, the various operations.

Credit and Diploma.

In order to obtain a diploma, the student must complete satisfactorily all the work required in the vocational course which he has selected. This course consists of five terms of class and laboratory instruction, supplemented by six months of practical experience gained between the second and third terms of resident instruction and subject to the approval of the supervisor of placement training. No student failing to meet the requirements of his six months' summer training can be enrolled for the three terms of the second year, since he is not entitled to the diploma of the School.

Graduates of county schools of agriculture or of agricultural departments of high schools may complete the course for a diploma in one year if they are recommended by the director of the county school or by the instructor in charge of the department of agriculture in the high school.

Special Catalog.

For a complete catalog of the Stockbridge School of Agriculture, containing an application blank, write or apply to Director Roland H. Verbeck, Massachusetts Agricultural College, Amherst, Mass.

THE WINTER SCHOOL.

Short Courses are based on the idea that the motive which inspires study is the most significant factor in study itself, and that this motive rises when the student himself realizes he faces a problem that calls for a solution. Therefore, there is no age limit. Enrolled in short courses are found the young and the old, the experienced and the inexperienced, the theoretical and the practical. In this grouping there is a value, since students learn from each other as well as from the instructors. Practically all Short Course students intend to make a direct application of the knowledge gained. Hence the aim of Short Course work is to offer the largest amount of information and training in agricultural and horticultural lines in the shortest possible time. During the past twenty years Short Courses have served hundreds of students in this Commonwealth, and the demand for these courses in recent years has steadily continued.

The Winter School has been established for a number of years at the college, and has proved to be very popular with farmers, their wives, sons, and daughters, teachers, college graduates, and others. This school begins about the first of January. Instruction will be offered this year in —

Field Crops.
Soil Fertility.
Animal Breeding.
Live Stock Feeding.
Types and Breeds of Live Stock.
Farm Accounts.
Farm Management.
Farm Motors.
Animal Diseases.
Dairy Bacteriology.
Horticultural Manufactures.
Vegetable Gardening.
Botany.
Entomology.
Rural Sanitary Science and Hygiene.
Marketing Farm Products.
Agricultural Opportunities for Women.
Food and Nutrition.
Textiles and Clothing.
Health Education.
Home Management.
Principles and Methods of Teaching.
Special Methods in Vocational Agricultural Teaching.
Agricultural Teaching Improvement Problems in Massachusetts.
Special Dairying Course.
Special Fruit Growing Course.
Special Greenskeepers Course.
Special Poultry Raising Course.
Practical and Scientific Course for Florists.

A series of special two-week courses in ice-cream making, butter making, milk testing, and market milk are offered. During the two weeks the student devotes

all of his time to the work of the special course in which he has enrolled. The instruction lasts throughout the day from 8 to 5. These courses meet a very definite need in the State for those who wish instruction, but who cannot attend for a longer period of time, and who do not wish to take other subjects.

Fees.

For all students taking the full ten-weeks term of the Winter School there is a tuition fee of $10 and, in addition, a registration fee of $5. There are no laboratory fees in connection with any of the courses.

For further information, write or apply to Roland H. Verbeck, Director of Short Courses, Massachusetts Agricultural College, Amherst, Mass.

REGISTRATION, 1929–30.

Graduate Students

From October 1, 1928, to October 1, 1929.

Superior figures indicate: [1] Enrolled during academic year 1928–29.
[2] Enrolled in Summer School 1929.
[3] Enrolled during academic year 1929–30.

Albrecht, Ira W.[2,3]. Chemistry. Agl. Education Westfield.
B.S., Columbia University.
Albro, Gardner M.[1,2,3]. Chemistry. Math. and Physics . . . Newport, R. I.
B.S., Rhode Island State College.
Andrews, John H.[2]. Agl. Education Vineyard Haven.
B.S., Massachusetts Agricultural College.
Batson, Ferris S.[3]. Landscape Architecture Perkinston, Miss.
B.S., Mississippi A. & M. College.
Battey, Hiram F.[2]. Agl. Education South Deerfield.
B.S., Norwich University.
Beeman, Marjorie E.[3]. Agl. Education Ware.
B.S., Massachusetts Agricultural College.
Black, Lewis H.[2]. An. Husbandry. Agl. Education Williamsburg.
B.S., Massachusetts Agricultural College.
Boisvert, Oscar[3]. Dairy Husbandry. Bacteriology. Lyster Station,
B.A.S., Laval University. Megantic Co., P.Q.
Bovarnick, Max[3]. Agl. Economics Mattapan.
B.S., Massachusetts Agricultural College.
Bower, James, Jr.[2]. Agl. Education. Science Holyoke.
B.S., Massachusetts Agricultural College.
Brady, Anna M.[2] New Bedford.
B.S.E., Bridgewater Normal School.
Briggs, Lawrence E.[1,3] Rockland.
B.S., Massachusetts Agricultural College.
Carlson, Oscar E.[2] Amherst.
B.S., Massachusetts Agricultural College.
Carpenter, David F.[1,2,3]. Agl. Education. Science Millers Falls.
B.S., Massachusetts Agricultural College.
Chandler, Frederick B.[1]. Botany. Chemistry Machias, Me.
B.S., University of Maine.
Clagg, Charles F.[1]. Entomology. Zoology. Barnstable.
B.S., Massachusetts Agricultural College.
Clague, John A.[3]. Horticulture Tacoma, Wash.
B.S., University of Washington.
Clark, Hermon R.[1,3]. Agl. Education. Engineering Springfield.
B.S., University of Maine.
Cowing, William A.[1,2,3]. Agl. Education. Science West Springfield.
A.B., Colby College.
Crooks, G. Chapman[1,2,3]. Chemistry. Bacteriology North Brookfield.
A.B., Amherst College.
Crowley, Francis J.[1]. Chemistry Amherst.
B.S., Massachusetts Agricultural College.
Dickinson, Lawrence S.[2]. Horticulture Amherst.
B.S., Massachusetts Agricultural College.
Doolittle, Vincent M.[1] New Britain, Conn.
B.Ag., Connecticut Agricultural College.
Elliott, Mrs. George R.[3] Amherst.
B.A., University of Wisconsin.
Farrar, Clayton L.[1,2,3]. Entomology. Botany Amherst.
B.S., Kansas State Agricultural College.
Flynn, Alan F.[2]. Agl. Education. Agl. Economics Sudbury.
B.S., Massachusetts Agricultural College.
Foley, Richard C.[1,3]. An. Husbandry. Agronomy. Portland, Me.
B.S., Massachusetts Agricultural College.
France, Ralph L.[1]. Microbiology. Math. and Physics . . . Amherst.
B.S., University of Delaware.
French, Arthur P.[1]. Pomology. Botany. Amherst.
B.S., M.S., Massachusetts Agricultural College.
Gates, Clifford O.[3]. Landscape Architecture Kokoma, Ind.
B.S.A., Purdue University.
Gilbert, Chauncey McL.[2,3] Amherst.
B.S., Massachusetts Agricultural College.
Giles, Marion B.[2] Northampton.
A.B., Smith College.
Ginsburg, Eli[1]. Chemistry. Math. and Physics Amherst.
B.A., Amherst College.
Goldberg, Maxwell H.[1] Stoneham.
B.S., Massachusetts Agricultural College.
Goodwin, William I.[1,3]. Agl. Economics North Amherst.
B.S., Massachusetts Agricultural College.
Griffiths, Francis P.[1,3]. Chemistry. Horticulture and Microbiology . . Seattle, Wash.
B.S., University of Washington.

Hebard, William E.[2]. Agl. Education Chester, Me.
B.A., University of Maine.
Hopkins, Alden[1, 3]. Landscape Architecture Chepachet, R. I.
B.S., Rhode Island State College.
Horne, Thomas R.[3]. Landscape Architecture Abbeville, Ala.
B.S., Alabama Polytechnic Institute.
Hutchings, Frank F.[2, 3]. Agl. Education. Science New Bedford.
B.S., Massachusetts Agricultural College.
Johnson, Edward D.[3]. Landscape Architecture Monmouth, Maine.
B.S., University of Maine.
Kakavas, James C.[1]. Bacteriology. Science Amherst.
B.S., Massachusetts Agricultural College.
Knight, Earl L.[2]. Agl. Education Amherst.
B.S., in Comm., Temple University.
Knudsen, Harold R.[1, 3]. Agronomy. Chemistry Amherst.
B.S., Brigham Young University.
Ladas, Constantine P.[1, 2, 3]. Agl. Education. Rural Sociology . . . Boston.
B.S., Massachusetts Agricultural College.
Landry, Herbert A.[1, 3]. Agl. Education. Microbiology West Springfield.
B.M.E., Northeastern University.
Larsinos, George J.[1, 3]. Agronomy. Chemistry Amherst.
B.S., M.S., Massachusetts Agricultural College.
Leivo, Thure M.[3]. Landscape Architecture New Castle, Pa.
B. Arch., Carnegie Institute Technology.
Linehan, Mary DeL.[2] Amherst.
Lippincott, Stuart W.[3]. Microbiology. Chemistry Worcester.
A.B., Clark College.
Lombard, William R.[1, 3] West Springfield.
A.B., Colby College.
Lowry, Wayne J.[1, 3]. Landscape Architecture Midland, Mich.
B.S., Michigan State College.
Lynch, Elizabeth A.[3]. Agl. Education. Landscape Architecture . . Easthampton.
B.S., Massachusetts Agricultural College.
Mackimmie, Alexander A., Jr.[1, 3]. Agl. Education Rural Sociology. . . North Amherst.
B.A., Amherst College.
MacMasters, Majel M.[1]. Chemistry. Botany Collinsville, Conn.
B.S., M.S., Massachusetts Agricultural College.
McDonnell, Charles P.[1]. Agl. Education West Springfield.
A.B., Catholic University.
McDowell, Ruth B.[1]. Agl. Education Mooers, N. Y.
B.S., Syracuse University.
Morgan, Ezra L.[1]. Rural Sociology. Agl. Economics Columbia, Mo.
A.B., McKendree College. Ag. Education
M.A., University of Wisconsin.
Morgan, William A.[2]. Agl. Education. Horticulture Flushing, N. Y.
B.S., Connecticut Agricultural College.
Moriarty, Helen E.[2]. Botany Holyoke.
A.B., Smith College.
Morse, Miriam[1, 2, 3]. Entomology. Zoology and Botany New Braintree.
B.S., St. Lawrence University.
Nelson, Paul R.[1] Holyoke.
B.S., Massachusets Agricultural College.
M.S., Lafayette College.
Newton, Richard C.[1, 3]. Entomology. Zoology and Botany . . . Middletown, Conn.
B.S., Connecticut Agricultural College.
O'Brien, Mary C.[1, 2]. Agl. Education Greenfield.
B.S.E., Normal Art School.
Packard, Faith E.[3] Crown Point, N. Y.
B.S., Massachusetts Agricultural College.
Parrott, Ernest M.[3]. Chemistry. Bacteriology and Physiology . . Cordova, Tenn.
B.S., Union University.
Parsons, Clarence H.[1, 3]. An. Husbandry. Agronomy North Amherst.
B.S., Massachusetts Agricultural College.
Parsons, Josiah W., Jr.[1] Northampton.
B.S., Massachusetts Agricultural College.
Pettee, Donald A.[1]. Dairy Husbandry. Agl. Economics and Bacteriology Francestown, N. H.
B.S., University of New Hampshire.
Pickard, Maurice H.[2]. Agl. Education Ware.
B.S., Tufts College.
Piekenbrock, Peter[1] Herford, Westphalia, Germany.
Ph.D., University of Halle.
Plantinga, Oliver S.[1, 2, 3]. Chemistry. Math. and Physics . . . Amherst.
B.S., Massachusetts Agricultural College.
Plantinga, Sarah T.[1, 3]. Agl. Education. Chemistry Amherst.
B.S., Massachusetts Agricultural College.
Plummer, Mary E.[2]. Agl. Education Northampton.
A.B., Smith College.
Proctor, Harriet E[1]. An. Husbandry. Poultry Husbandry . . . South Weymouth.
B.S., Massachusetts Agricultural College.
Rabinowitz, Joseph[1]. Agl. Economics. Agl. Education Brooklyn, N. Y.
B.S., Connecticut Agricultural College.
Reed, James P.[2]. Agl. Education. Rural Sociology Hadley.
B.S., University of Vermont.
Rice, Cecil C.[1]. Horticulture. Agl. Economics and Chemistry . . Worcester.
B.S., Massachusetts Agricultural College.
Rice, Victor A.[1]. An. Husbandry. Zoology Amherst.
B.S., North Carolina State College.
M.Ag., Massachusetts Agricultural College.
Robbins, Zila[1] Indianapolis, Ind.
B.A., Cornell College.
Roberts, Oliver C.[1]. Pomology Amherst.
B.S., Massachusetts Agricultural College.

Rohde, Gustav [3] Halle, Germany.
D.Sc., University of Halle.
Salman, Kenneth A. [1, 2, 3]. Entomology. Chemistry. Botany and Zoology Amherst.
B.S., Massachusetts Agricultural College.
Sessions, John A. [1] Hadley.
A.B., Harvard University.
Seymour, Frank C. [1]. Agl. Education. Botany North Amherst.
A.B., Harvard University.
B.D., Union Theological Seminary.
Smith, Noel V. W. [2] Northampton.
B.S., Rhode Island State College.
Smith, Walter R. [1, 2, 3]. Chemistry. Math. and Physics Holden.
B.S., Massachusetts Agricultural College.
Spear, John A. [1] Amherst.
B.A., M.A., Amherst College.
Steinbugler, Elizabeth R. [1] Brooklyn, N. Y.
B.S., Massachusetts Agricultural College.
Stewart, Sarah E. [1, 2, 3]. Bacteriology. Chemistry Las Cruces, N. Mex.
B.S., New Mexico Agricultural College.
Stitt, Rhea E. [1, 2, 3]. Agronomy. Botany Huron, S. Dak.
B.S., South Dakota State College.
Sullivan, John A. [2, 3]. Agl. Education. Veterinary Sci. and Botany . . Medford.
B.S., Massachusetts Agricultural College.
Sweetman, Harvey L. [3]. Entomology. Zoology. Botany . . . Las Animas, Colo.
B.S., Colorado Agricultural College.
M.S., Iowa State College.
Towne, Carroll A. [1]. Landscape Architecture Amherst.
B.S., Massachusetts Agricultural College.
Tulenko, John T., Jr. [1]. Chemistry. Botany Sunderland.
B.S., Massachusetts Agricultural College.
Van Meter, Ralph A. [1, 3]. Pomology. Agl. Education. Mathematics . Amherst.
B.S., Ohio State University
Vincent, Clarence C. [1]. Pomology. Entomology. Botany and Landscape
B.S., M.S., Oregon State College. Architecture Moscow, Idaho.
M.S., Cornell University.
Wildon, Carrick E. [1]. Floriculture. Botany Kingston, R. I.
B.S., Massachusetts Agricultural College.
White, Mildred W. [2] Amherst.
A.B., Connecticut College.

Summary Graduate Students.

	Men.	Women.	Total.
Enrolled during academic year 1928–29	50	9	59
Enrolled in Summer School, 1929	26	9	35
Enrolled during academic year 1929–30	41	7	48
Total excluding duplications	80	19	99

Undergraduate Students.
1930.

Allen, Herbert Adams	Fitchburg	8 North College.
Allen, Raymond Clayton	Barre	French Hall.
Ames, Winthrop Ashley	Amherst	32 North Prospect Street.
Andrew, John Albion, Jr.	West Boxford	Alpha Gamma Rho.
Armstrong, Robert Lindsey	East Sandwich	13 North College.
Atwood, Rachel	Greenfield	The Homestead.
Babson, Osman	Gloucester	9 Mt. Pleasant.
Bedford, Harry	Whitinsville	Alpha Gamma Rho.
Benoit, Edward George	Chicopee Falls	8 North College.
Berggren, Stina Matilda	Worcester	Abigail Adams House.
Bernard, Sergius Joseph	North Adams	10 South College.
Billings, Samuel Clark	Belmont	2 North College.
Bishop, Frank Millard	Natick	Alpha Sigma Phi.
Bond, Richard Henry, Jr.	Needham	Phi Sigma Kappa.
Brackley, Floyd Earle	Strong, Maine	Alpha Sigma Phi.
Brown, Mildred Shepard	North Amherst	North Amherst.
Buckler, May Frances	Pittsfield	The Homestead.
Burbank, Oscar Frank, Jr.	Worcester	Phi Sigma Kappa.
Call, Reuben Hillman	Colrain	Alpha Gamma Rho.
Campbell, Harold Vining	Leyden	3 North College.
Cleveland, Maurice Mortimer	East Pepperell	16 South College.
Cook, Charles Hardy	Beverly	Theta Chi.
Coven, Milton Isadore	Springfield	14 South College.
Cox, Adelbert Winters	Framingham	10 South College.
Cox, Charles Bartlett	Boston	Kappa Sigma.
Davis, Gertrude Jordan	Auburndale	Abigail Adams House.
Day, William Albert Palmer	Watertown	13 Phillips Street.
Dean, Lucien Wesley	Millis	Q. T. V.
Decker, Charlotte Marthe	Holyoke	70 Lincoln Avenue.
Denny, Mertle Althea	Northampton	The Homestead.
Denton, Edward Wemyss	Framingham	26 Fearing Street.
Donovan, Margaret Pauline	Bondsville	Abigail Adams House.
Dover, Evelyn	Methuen	The Homestead.
Drew, William Brooks	Belmont	Phi Sigma Kappa.
Ellert, Fred Charles	Holyoke	9 South College.
Elliot, Davis Haskins	South Westport	Sigma Phi Epsilon.
Frame, Charles Frederick	Rockland	North College.
Gaumond, Alice Delimen	Southbridge	Abigail Adams House.
Goodell, Herbert Andrew	Southbridge	14 North College.
Goodell, Hermon Ulysses	Southbridge	14 North College.
Goodnow, Robert Gibson	Mendon	West Experiment Station.

Grunwaldt, Lucy Antoinette	Springfield	The Homestead.
Gunn, Ralph Ellis	South Jacksonville, Fla.	Theta Chi.
Hammond, Clarence Elliot	Needham	Kappa Sigma.
Harris, Charles Whitcomb, Jr.	Leominster	Theta Chi.
Haubenreiser, Elsie Martha	Springfield	70 Lincoln Avenue.
Hernan, Richard Alden	Gilbertville	Q. T. V.
Hetherington, Thomas	Fall River	Sigma Phi Epsilon.
Hinchey, Anne Elizabeth	Palmer	Abigail Adams House.
Howard, Lucius Alexander	Ridgewood, N. J.	Phi Sigma Kappa.
Howard, Martin Stoddard	Northfield, Vt.	Phi Sigma Kappa.
Hunt, Kenneth Whitten	Springfield	Kappa Sigma.
Huthsteiner, Elladora Kathryn	Pittsfield	Abigail Adams House.
Jensen, Henry Wilhelm	Boston	2 North College.
Jones, Fred William	Otis	3 North College.
Joy, John Leo William	Amherst	Alpha Sigma Phi.
Kinney, Asa Foster	South Hadley	Kappa Sigma.
Labarge, Robert Rolland	Holyoke	Kappa Epsilon.
Lawlor, John Thomas, Jr.	Marblehead	86 Pleasant Street.
Loud, Miriam Johnson	Plainfield	Abigail Adams House.
Lynds, Lewis Malcolm	Taunton	Sigma Phi Epsilon.
MacCausland, Mabel Alice	West Newton	Abigail Adams House.
Madden, Archie Hugh	Amherst	13 North College.
Magnuson, Herman Rainville	Manchester	Q. T. V.
Mann, Raymond Simmons	Dalton	Sigma Phi Epsilon
Manwell, Flora Eleanor	Williamsburg	Abigail Adams House.
Marcus, Theodore	Roxbury	East Experiment Station.
Maylott, Gertrude	Worcester	Homestead.
McIsaac, Donald Weston[1]	East Weymouth	7 North College.
McKay, Catherine Mary	Newtonville	Abigail Adams House.
Morgan, Isabel Elvira	Schenectady, N. Y.	44 Triangle Street.
Morse, Beryl Florence	Southbridge	Abigail Adams House.
Murphy, Donald Fraser	Lynn	Stockbridge Hall.
Nickerson, Ralph Francis	Attleboro	Sigma Phi Epsilon.
Nims, Russell Everett	Greenfield	12 South College.
O'Leary, William Joseph	Northampton	Alpha Sigma Phi.
Packsarian, John Paul	Franklin	Q. T. V.
Phinney, William Roland	Willimansett	Kappa Epsilon.
Pillsbury, William Gale	Amesbury	Theta Chi.
Pollin, Ida Edith	Springfield	33 Lincoln Avenue.
Pottala, Arne Eric	Fitchburg	Sigma Phi Epsilon.
Purdy, Wilfred George	Amherst	Q. T. V.
Pyle, Arthur Guard	Plymouth	Theta Chi.
Riley, Vincent Joseph	Somerset	Alpha Sigma Phi.
Robertson, Harold Miner	Leyden	Kappa Sigma.
Ronka, Lauri Samuel	Gloucester	7 North College.
Rudman, Paul Arthur	Agawam	83 Pleasant Street.
Sandstrom, Evelyn Cecelia	Auburn	Abigail Adams House.
Saraceni, Raphael	Lynn	Mathematics Building.
Sederquist, Arthur Butman, Jr.	Peabody	Theta Chi.
Singleton, Eric	Brooklyn, N. Y.	Theta Chi.
Skogsberg, Frank Albert[1]	Worcester	Theta Chi.
Smith, Raymond Francis	Needham	Kappa Sigma.
Smith, Winthrop Grant	Needham Heights	Kappa Sigma.
Spooner, Laurence Whipple	Brimfield	President's House.
Stacy, Paul	West Yarmouth	Q. T. V.
Stanford, Spencer Clarendon	Rowe	Alpha Sigma Phi.
Stiles, Alice Goodrich	Westfield	Abigail Adams House.
Stone, Ruth Winifred	Holyoke	Abigail Adams House.
Suher, Maurice	Holyoke	14 South College.
Sullivan, William Nicholas, Jr.	Lawrence	3 North College.
Swift, Gilbert Dean	Melrose	Phi Sigma Kappa.
Taft, Jesse Alderman	Mendon	Phi Sigma Kappa.
Taft, Roger Sherman	Sterling	Alpha Sigma Phi.
Tank, John Richard	Chatham, N. Y.	Sigma Phi Epsilon.
Thatcher, Christine Belle	Cummington	10 Hallock Street.
Tomfohrde, Karl Martin	West Somerville	Theta Chi.
Vaughan, Herbert Sidney	Attleboro	Stockbridge Hall.
Wadleigh, Cecil Herbert	Milford	Phi Sigma Kappa.
Waechter, Peter Hansen, Jr.	Walpole	Lambda Chi Alpha.
White, Frank Tisdale, Jr.	Holbrook	Alpha Sigma Phi.
White, Harold James	Brighton	9 South College.
Wood, Priscilla Grover	West Bridgewater	Abigail Adams House.
Woodin, Elizabeth Marie	Adams	Abigail Adams House.
Zuger, Albert Peter	New Haven, Conn.	Alpha Sigma Phi.

Class of 1931

Barrus, George Alvan	Lithia	Clark Hall.
Barry, Elizabeth Evans	Lynn	Abigail Adams House.
Bartlett, Leonard, Jr.	East Walpole	Lambda Chi Alpha.
Bartsch, Nelson Edgar	Waverley	Phi Sigma Kappa.
Beaman, Evelyn Armstrong	Leverett	Abigail Adams House.
Bonney, Walter Twichell	Springfield	10 North College.
Bosworth, William Ezra, Jr.	Holyoke	9 North College.
Bottomly, Bruce Ely	Worcester	12 North College.
Bradley, Sally Elizabeth	Lee	Abigail Adams House.
Brooks, John Hapgood, 3rd	Worcester	46 Pleasant Street.
Brown, Alfred Alexander	Methuen	French Hall.
Buck, Wilbur Francis	Stockbridge	Lambda Chi Alpha.

[1] Candidate for Degree of Bachelor of Vocational Agriculture.

Burnham, Catharine Annette	Shelburne	Care of C. Thompson, Mount Pleasant.
Cahoon, Mildred Adeline	Centerville	Abigail Adams House.
Calvi, John	Athol	16 North College.
Carpenter, Henry Dunphe	Bridgewater	Q. T. V.
Chadwick, Alan William	Worcester	Lambda Chi Alpha.
Chenoweth, Winifred Lee	North Amherst	North Amherst.
Clarkson, Marjorie	Worcester	Abigail Adams House.
Cucinotta, Lewis Bohlin	Camden, Me.	Alpha Sigma Phi.
Dangelmayer, Wynton Reid	Waltham	Lambda Chi Alpha.
Daniels, Arthur Richards	Dedham	Q. T. V.
Darling, Herbert Daniel	Allston	Lambda Chi Alpha.
Davis, Arnold Mearns	Berlin	Alpha Gamma Rho.
Davis, George Merrill	South Lee	Kappa Sigma.
Davis, Richard William	Melrose	15 North College.
DeFalco, Iris Norma	North Adams	Abigail Adams House.
Digney, Anna Katherine	Dorchester	Abigail Adams House.
Field, George White	Florence	Florence.
Field, Mabel Klose	Sheffield	Abigail Adams House.
Fitzgerald, Paul Richard	Revere	Colonial Inn.
Flood, George Millard	North Adams	83 Pleasant Street.
Frey, Newell William	South Hadley Falls	Kappa Epsilon.
Friedrich, Thelma Selene	Florence	Abigail Adams House.
Frost, Edmund Locke	Arlington	Phi Sigma Kappa.
Goodrich, Raymond Eldred	Amherst	3 South East Street.
Gordon, Jeane	Holyoke	Abigail Adams House.
Gorman, Joseph William	Upton	Phi Sigma Kappa.
Gower, Albert Hugh	Brighton	Kappa Epsilon.
Griffith, Janet Anne	Wareham	Abigail Adams House.
Guenard, John Robert	Dracut	Sigma Phi Epsilon.
Hacker, Walter Breed	Natick	11 North College.
Hamilton, Stephen Lane	New Salem	Q. T. V.
Hanslick, Otis Henry	Somerville	Care of L. Carey, North Pleasant.
Hastings, Emory Barton	Athol	4 Chestnut Street.
Hines, Francis Martin	Arlington	Alpha Gamma Rho.
Holm, Carl Gustaf [1]	Worcester	Alpha Gamma Rho.
Holway, Alfred Harold	Holyoke	46 Claremont Avenue, Holyoke.
Johnson, Arthur Clement Marriott	Greenfield	11 South College.
Jones, Lawrence Arthur	Greenfield	11 South College.
Kane, Eugene Joseph	Westfield	Q. T. V.
Kimball, Philip Wadsworth	Northboro	16 North College.
King, Marc Nesmith	Waltham	Lambda Chi Alpha.
Kitner, William Robert	Westfield	Sigma Phi Epsilon.
Kneeland, Ralph Folger, Jr.	Quincy	Alpha Sigma Phi.
Koerber, Margaret Eleanore	Northampton	Abigail Adams House.
Lawrence, John Cheney	Brimfield	President's House.
LeClair, Gertrude Leah	Southbridge	Abigail Adams House.
Little, Charles Lunt	West Medford	15 South College.
Loar, Russell Dudley	Longmeadow	Davenport Inn.
Loomis, Randall Miller	Easthampton	22 Pleasant Street, Easthampton.
Lorrey, Robert Henry	Watertown	16 South College.
Lyman, Evelyn May	East Longmeadow	Abigail Adams House.
Manty, Charles Weikko	Maynard	Lambda Chi Alpha.
Marshall, Mary Moore	Whitinsville	Abigail Adams House.
Mason, Frank Ford, Jr.	Williamstown	West Experiment Station.
McGuckian, John William	Roslindale	Q. T. V.
McKeen, Richard Potter	Watertown	Q. T. V.
Mead, Gertrude Alice	Townsend	Abigail Adams House.
Minkstein, Thomas Edward	Westfield	Q. T. V.
Meyer, Beatrice Florentine	Northampton	Abigail Adams House.
Myrick, Norman	Longmeadow	16 North College.
Nash, Clyde Woodbury	Haverhill	83 Pleasant Street.
Nason, David Mitchell	Medford	83 Pleasant Street.
Norell, Frieda Brita	Amherst	2 Mount Pleasant.
Northcott, John Warren, Jr.	New Bedford	Alpha Gamma Rho.
Nott, George Edwin	Brookfield	10 North College.
Oliver, George West	Watertown	15 North College.
Pierce, Gertrude Keith	Shelburne Falls	Abigail Adams House.
Plantinga, Martin Peter	Amherst	18 North East Street.
Potter, Rial Strickland, Jr.	Springfield	Care of W. Webb, Baker Lane.
Pray, Francis Civille	Amherst	Phi Sigma Kappa.
Priest, Arthur George	Windsor, Conn.	Lambda Chi Alpha.
Pyenson, Louis	East Lee	13 South College.
Reuter, Anna-May	Northfield	Abigail Adams House.
Rooney, Robert Colbert	Reading	9 North College.
Rubin, Theodore	Brooklyn, N. Y.	13 South College.
Runvik, Kenneth Carl	Detroit, Mich.	Kappa Epsilon.
Russell, Grace Shirley	Easthampton	Abigail Adams House.
Scott, Ruth Elizabeth	North Hadley	Abigail Adams House.
Shaw, Frank Robert	Belchertown	Belchertown.
Shepard, Laurence Moody [1]	West Boylston	Theta Chi.
Smith, Ernest Gordon	Medford	15 North College.
Smith, Paul Augustus	Malden	15 South College.
Somes, John	Otis	11 North College.
Spiewak, Pauline Anna	Holyoke	Abigail Adams House.
Stevenson, Errol Burton	Brockton	Stockbridge Hall.

[1] Candidate for Degree of Bachelor of Vocational Agriculture.

Stoddard, Herbert Tilden	Cohasset	Inwoods.
Stuart, Robert Emerson	Littleton	66 Lincoln Avenue.
Takahashi, Leopold Hanzo	Amherst	37 Whitney Street.
Tashjian, Louren Markar	Amherst	11 North College.
Tiffany, Don Cecil	Cambridge	17 North College.
Tucker, Robert Barclay	Middleboro	Kappa Sigma.
Upton, Shirley	North Reading	Care of Mrs. Hobart, North Amherst.
Vincent, Lionel Lewis	Westminster	M. A. C. Farmhouse.
Wahlgren, Hardy Lewis	Melrose	94 Pleasant Street.
Warren, Allen Johnson	New Haven, Conn.	Theta Chi.
West, Allen Sherman, Jr.	Springfield	Kappa Sigma.
Westendarp, Edwin Maurice	Saugus	Phi Sigma Kappa.
White, Edwin Theron	Millbury	Alpha Gamma Rho.
Whittum, Frederick Kingsley	Springfield	Kappa Sigma.
Williams, Inez Wilhelmenia	Brockton	Abigail Adams House.
Woods, James Joseph, Jr.	Leominster	Alpha Gamma Rho.
Wright, Denise	Amherst	116 Pleasant Street.
Yeatman, Alwyn Frederick	Springfield	Phi Sigma Kappa.

CLASS OF 1932

Aldrich, George Elliott	Northampton	Pine Street, North Amherst.
Anderson, Carrolle Elizabeth	Ashfield	Ashfield.
Anderson, Mabelle Lydia	Southwick	Abigail Adams House.
Astore, John Joseph	West Stockbridge	31 North Prospect Street.
Baker, Walter Connor	Franklin	Q. T. V.
Batstone, William Frank	West Newton	Theta Chi.
Betts, Benjamin Davenport	Norwalk, Conn.	Sigma Phi Epsilon.
Black, Mary Egesta	Williamsburg	8 Allen Street.
Boland, Katherine	Dracut	Abigail Adams House.
Boston, Margaret Mary	Newtonville	Abigail Adams House.
Brown, Arthur Endicott	Wayland	Phi Sigma Kappa.
Bunten, John Frederick	Brockton	Kappa Sigma.
Burnham, John [1]	Shelburne Falls	97 Pleasant Street.
Burrington, John Cecil, Jr.	Charlemont	56 Pleasant Street.
Caird, Wynne Eleanor	Dalton	Abigail Adams House.
Carter, Forrest Edward	Wakefield	Q. T. V.
Chapman, Kenneth William	Springfield	Lambda Chi Alpha.
Chase, Herbert Manton, Jr.	Newport, R. I.	Kappa Sigma.
Cheney, Howard Alton	Springfield	Kappa Sigma.
Church, Gertrude Barber	North Amherst	North Amherst.
Clark, Webster Kimball, Jr.	West Deerfield	Q. T. V.
Cohen, William	Springfield	Far View Way.
Connell, Philip Joseph	Springfield	Sigma Phi Epsilon.
Costello, John Paul	Franklin	Q. T. V.
Crawford, Forrest Emerson	Waverley	Theta Chi.
Davis, William Proud	Waltham	Lambda Chi Alpha.
DeGelleke, Peter	Troy Hills, N. J.	15 Phillips Street.
DeLisle, Albert Lorenzo	South Hadley Falls	453 Newton Street, South Hadley Falls.
Dickinson, Thelma Louise	Greenwich	Abigail Adams House.
Diggs, Robert Lewis	Brighton	81 Pleasant Street.
Dods, Agnes Miriam	Leverett	Montague.
Doerpholz, Eunice Miverva	Holyoke	314 Hillside Ave., Holyoke.
Donaghy, Edward Joseph [2]	New Bedford	4 North College.
Douglass, Frank Taylor	Springfield	Alpha Gamma Rho.
Doyle, James Edward	Northampton	Kappa Epsilon.
Durkee, Pauline Agnes [2]	Amherst	120 Pleasant Street.
Dyer, Cora Gennette	Northampton	Abigail Adams House.
Edmond, Stuart Deane	Amherst	8 South Prospect Street.
Efimchenko, Basil Matthew	Russia	12 South College.
Eldridge, Richard Albert	South Chatham	Alpha Sigma Phi.
Evans, Richard Warren	North Attleboro	3 Fearing Street.
Everson, Bettina Lowell	Amherst	North Pleasant Street.
Fabyan, Warren White [1]	East Weymouth	Q. T. V.
Fiore, Celeste	Montclair, N. J.	Abigail Adams House.
Fisher, William Sidney, Jr.	Mount Ephraim, N. J.	54 Lincoln Avenue.
Fletcher, Robert Bliss	Worcester	Theta Chi.
Foley, John Joseph	Amherst	Kappa Sigma.
Folger, Richard Sloan	Roslindale	22 Fearing Street.
Fontaine, Arthur Lewis	Allston	86 Pleasant Street.
Forest, Herbert Leon	Arlington	Cosby Avenue.
Foskett, Clifford Robert [1]	East Weymouth	Q. T. V.
Foster, Philip Woolsey	Hancock, N. Y.	Stockbridge Hall.
Fraser, Richard Arthur	Lowell	Alpha Gamma Rho.
Gagliarducci, Vincent Nicholas	Springfield	Colonial Inn.
Gilgut, Constantine Joseph	Athol	3 Fearing Street.
Goodall, Leslie Duncan	Winthrop	15 South College.
Gordon, Laura Elizabeth	Ipswich	Abigail Adams House.
Gorey, Robert Francis	South Deerfield	Sigma Phi Epsilon.
Gula, Joseph John	Bondsville	3 Fearing Street.
Gunness, Robert Charles	Amherst	105 Butterfield Terrace.
Hale, Kenneth Fowler	Tolland	Sigma Phi Epsilon.
Hale, Nathan Shirley [1]	Rowley	West Experiment Station.
Hanks, Harry Mason, Jr.	Longmeadow	Phi Sigma Kappa.
Haynes, Arnold Calvin	Springfield	Phi Sigma Kappa.
Hicks, Murray Ballou	Williamstown	Alpha Gamma Rho.

[1] Candidate for the Degree of Bachelor of Vocational Agriculture.
[2] Admitted on probation; entrance record incomplete.

Hitchcock, John David	West Medway	42 Lincoln Avenue.
Hodge, Kenneth Elba	Monson	97 Pleasant Street.
Holder, Eben Daniel [2]	Hudson	Q. T. V.
Holmberg, Oscar Edward	Waltham	Lambda Chi Alpha.
Holz, Henry	North Andover	Alpha Gamma Rho.
Howe, Elizabeth Vose	South Acton	Abigail Adams House.
Howe, Evan Carleton	Norfolk	Theta Chi.
Howlett, Carey Harris	Southampton	Kappa Sigma.
Humphreys, Grace Augusta	Amherst	32 Amity Street.
Hunter, Marion Brockway	Holyoke	Abigail Adams House.
Isham, Beatrice Catherine	Ludlow	Abigail Adams House.
Johnson, Erik Alfred	Springfield	Alpha Gamma Rho.
Jorczak, Joseph Stanley	Chicopee	Q. T. V.
Kaylor, John Daniel	Fall River	86 Pleasant Street.
Keyes, Curtis Gilbert	Whitinsville	Alpha Gamma Rho.
Killeen, John Bernard, Jr. [2]	Cambridge	81 Pleasant Street.
King, George Lester	Methuen	17 North College.
King, Stuart Emerson	Boston	6 Nutting Avenue.
Lake, Susan Glidden	Plainville	Abigail Adams House
Lamb, Francis Bleakie	White Plains, N. Y.	Phi Sigma Kappa.
Lawrence, Edwina Frances	Springfield	Abigail Adams House.
Lawrence, John Frederick [1]	Brimfield	4 Chestnut Street.
Lepie, Joseph Edward	Dorchester	5 North College.
Levine, Harry	Springfield	19 Pleasant Street.
Libbey, William Clinton	Westboro	The Apiary.
Loomer, Edward Alfred	Abington	Kappa Sigma.
MacLean, John Douglas	West Bridgewater	51 Amity Street.
Mamaqui, Nusret Osman	Albania	Experiment Station.
Margolin, Oscar	Newtonville	Poultry Plant.
Markus, Christine Veronica	Monson	Abigail Adams House.
Mason, Donald Mowatt	South Easton	Kappa Sigma.
Merritt, Orris Elma	Sheffield	Abigail Adams House.
Merritt, Richard Hyde	Williamsburg	63 Pleasant Street.
Miller, Frank Edward, Jr.	Lynn	Mathematics Building.
Mitchell, Ernest Wilson, Jr.	Newburyport	6 North College.
Mitchell, Robert Dawson	Holyoke	18 Nutting Avenue.
Monk, Marjorie	Longmeadow	Abigail Adams House.
Morrison, Florence Lee	New Orleans, La.	Abigail Adams House.
Nelson, Harmon Oscar, Jr.	Whitinsville	12 North College.
O'Donnell, Patrick Edward	North Abington	45 Fearing Street.
Ohlwiler, Margaret Amelia	Southbridge	Abigail Adams House.
Oliver, Thomas Joseph	Gloucester	Alpha Sigma Phi.
Parker, William Hooper	Gorham, Me.	86 Pleasant Street.
Parsons, Anna Thankful	Southampton	Abigail Adams House.
Peck, Hazel Bernice	Springfield	Abigail Adams House.
Pollard, Robert Lonsdale	Amherst	North Hadley Road.
Pollin, Lillian Pauline	Springfield	33 Lincoln Avenue.
Prince, Carlton Gordon	Adams	75 Pleasant Street.
Raplus, Harry Edward	East Longmeadow	Kappa Epsilon.
Reed, Elizabeth Ruth	Dalton	Abigail Adams House.
Reed, Virginia	Waltham	Abigail Adams House.
Rice, Clara Ruth	Charlemont	Care of Dr. Chamberlain, Mount Pleasant.
Rice, George Comerford	Needham	Alpha Sigma Phi.
Roffey, Robert Cameron	Rockport	Alpha Sigma Phi.
Ross, Paul Howard	Waltham	10 McClellan Street.
Ryan, John Bartlett, Jr.	Swampscott	Alpha Sigma Phi.
Saffer, Ralph Michel [2]	Springfield	86 Pleasant Street.
Salenius, Charles Henry	Hingham	97 Pleasant Street.
Salisbury, Alston Moore	Melrose Highlands	26 Fearing Street.
Salter, Leonard Austin, Jr.	Springfield	Lambda Chi Alpha.
Schoonmaker, John Warder	Amherst	R. F. D. 1.
Smart, Harry Hall	Waltham	Alpha Sigma Phi.
Smith, Aleck	Everett	17 North College.
Smith, George Gilman	Lebanon, N. H.	1 North College.
Soja, Stephen Stanley	North Wilbraham	42 Cottage Street.
Springer, Frank Leslie	Arlington	1 North College.
Stiles, Charles Andrew	Fairhaven	116 Pleasant Street.
Storey, Carl Herbert	Springfield	Far View Way.
Stuart, Wallace Wyman	Littleton Common	66 Lincoln Avenue.
Taylor, Avis Ruth	Dedham	Abigail Adams House.
Taylor, Clarisse Marie	Lee	Abigail Adams House.
Teague, Lynwood Patterson [1]	North Weymouth	Alpha Sigma Phi.
Tetro, Robert Carl	Williamsburg	Alpha Gamma Rho.
Thompson, Elmer Joseph	Brookline	Kappa Sigma.
Tikofski, John William	Walpole	Lambda Chi Alpha.
Tippo, Oswald	Jamaica Plain	4 North College.
Towle, Gifford Hoag [2]	Holden	Davenport Inn.
Troy, Frederick Sherman	Arlington	Colonial Inn.
Twiss, Mildred Florence	Hudson	Abigail Adams House.
Utley, Walter Sampson	Chesterfield	35 Lincoln Avenue.
VanLeer, Hans Lodewijk	Hilversum, Holland	Sigma Phi Epsilon.
Vichules, Marguerite Veronica	Northampton	7 Maple Street, Northampton.
Voorneveld, William, Jr.	Nantucket	Kappa Sigma.
Waite, Harold Vita Montefiore	Northampton	Lambda Chi Alpha.
Wanegar, Melvin Harold	Montague City	7½ East Pleasant Street.
Warner, Lulu Harriet	Amherst	Shays Street.
Waskiewicz, Edward Julian	Three Rivers	3 Fearing Street.

[1] Candidate for Degree of Bachelor of Vocational Agriculture.
[2] Admitted on probation, entrance record incomplete.

Watson, Edward Winslow	Plymouth	Phi Sigma Kappa.
Wear, William Homer	Waltham	Lambda Chi Alpha.
Webb, Pauline Alice	Goshen	Abigail Adams House.
Wendell, Charles Butler, Jr.	Belmont	Phi Sigma Kappa.
Wetterlow, Eric Hilding, Jr.	Manchester	Phi Sigma Kappa.
Wheeler, Kenneth Monroe	Great Barrington	Alpha Gamma Rho.
Wherity, Richard White	Scituate	Alpha Sigma Phi.
Whitten, Gilbert Yould	Melrose	Lambda Chi Alpha.
Wilson, James Louis	Ashland	9 North College.

CLASS OF 1933

Adams, Lucile Elizabeth	East Lee	Abigail Adams House.
Ahlstrom, Clifton Nils	Braintree	14 McClellan Street.
Anderson, Alice Gunhild	Everett	Abigail Adams House.
Anderson, Karl Olaf	Boston	Care of W. Webb, Baker Lane.
Armstrong, Irene Elizabeth	East Sandwich	Abigail Adams House.
Asquith, Dean	Lowell	83 Pleasant Street.
Barnes, Gertrude Agnes	Richmond	Abigail Adams House.
Barr, John Butler	Lowell	83 Pleasant Street.
Bearse, Arthur Everett	Sharon	81 Pleasant Street.
Bedord, Wilfred Hugh	Rutland	27 Fearing Street.
Beeler, Nelson Frederick	Adams	6 Nutting Avenue.
Beeman, Evelyn Elizabeth	Ware	Abigail Adams House.
Bell, Burton Brainard	Addison, Conn.	31 North Prospect Street.
Bennett, Stephen Wiggins[1]	Worcester	6 Phillips Street.
Best, Dorothy Gertrude	Holyoke	Abigail Adams House.
Bickford, Ralph Henry	Cheshire	6 Nutting Avenue.
Bigelow, Laurence Goding	Still River	61 Amity Street.
Billings, Reginald Winslow	Plainfield	27 Fearing Street.
Bishop, Herbert Lorimer, Jr.	Worcester	30 Fearing Street.
Bowler, Gerald Thomas	Westfield	50 Northampton Road.
Brackett, Muriel Viola	Marblehead	Abigail Adams House.
Brown, Chester Cromwell	Wayland	84 Pleasant Street.
Brown, Kendall Reddington[2]	Short Beach, Conn.	75 Pleasant Street.
Brown, Thurl Dryden	Danvers	Alpha Gamma Rho.
Bulman, James Cornelius	Greenfield	45 Fearing Street.
Cain, George Herbert	Braintree	Alpha Gamma Rho.
Caragianis, Costas Louis	Dracut	61 Amity Street.
Cary, Marjorie Elizabeth	Lyonsville	Abigail Adams House
Chenoweth, Howard Whitten	North Amherst	North Amherst.
Clancy, Carl Francis	Dedham	44 Sunset Avenue.
Clark, Charles Edward[2]	Bedford	Care of W. Webb, Baker Place.
Clark, Frances Harriet	Dodge	Abigail Adams House.
Crosby, David	Wakefield	29 Lincoln Avenue.
Crowell, John Brewer	Boonton, N. J.	15 Phillips Street.
Cummings, Benton Pierce	Ware	61 Amity Street.
Cummings, Herbert Vincent	Ware	96 Pleasant Street.
Dansie, Thomas Charles	Cambridge	Care of J. Howard, North Pleasant Street.
Dechter, Joseph Maxwell	Chelsea	Cottage Street Extension.
Dunn, Albert Carleton	Acton	Theta Chi.
Dyar, George Wellington	Waltham	Stockbridge Hall.
Eldredge, Josephine	Chatham	Abigail Adams House.
Fawcett, Edward Gilbert	Amherst	70 Lincoln Avenue.
Forer, Ida[2]	Holyoke	19 Pleasant Street.
Fowler, John Malcom	West Newton	75 Pleasant Street.
Frecheville, Honore Hamilton	London, England	Care of F. Kenney, Mount Pleasant.
Gagnon, Russell Thomas	Gloucester	Alpha Sigma Phi.
Gallup, Edward Louis	Norfolk	86 Pleasant Street.
Garity, Agnes Elinor	Boston	Abigail Adams House.
Gerrard, Margaret Lawrence	Holyoke	Abigail Adams House.
Gertz, Max Benjamin	Everett	56 Pleasant Street.
Gilmore, Samuel Rand	Wrentham	83 Pleasant Street.
Ginsburgh, Irene Rebecca	Westfield	19 Pleasant Street.
Gleason, Cloye Tilden	Hanover	4 Chestnut Street.
Goodstein, William Victor	New York, N. Y.	14 South College.
Goodwin, Azor Orne	Marblehead	Kappa Epsilon.
Gordon, Virginia	Amherst	38 Lincoln Avenue.
Gould, John Arthur	Ware	61 Amity Street.
Griffin, Katherine Patricia	Holyoke	Abigail Adams House.
Guralnick, Abraham Eugene	Roxbury	9 Phillips Street.
Gurney, Ashley Buell	Cummington	83 Pleasant Street.
Hager, William Perry	South Deerfield	South Deerfield
Hale, Helen Culvor	South Hadley Falls	Abigail Adams House.
Hammond, Richard Clayton	Quincy	81 Pleasant Street.
Hanson, Robert	Wayland	18 Nutting Avenue.
Hartford, Lionel Cyrus, Jr.	Springfield	22 Fearing Street.
Harvey, Edward Winslow	Amherst	9 Spring Street.
Harvey, Scott Heath	Amherst	101 West Street.
Havey, Frank Leslie	Attleboro	10 Nutting Avenue.
Hicks, Richard Ellsworth	Williamstown	9 Phillips Street.
Hodsdon, George Edward, Jr.	Gloucester	44 Sunset Avenue.
Homeyer, Charles William, Jr.	Wellesley Hills	75 Pleasant Street.
Hornbaker, Robert Weeks	Worcester	Care of J. Howard, North Pleasant Street.

[1] Candidate for Degree of Bachelor of Vocational Agriculture.
[2] Admitted on probation, entrance record incomplete.

Iosford, Robert Stanley	Springfield	97 Pleasant Street.
Iouran, Gordon Andrew	Ashburnham	8 Nutting Avenue.
Iowes, Robert Milton	Swift River	83 Pleasant Street.
Iubbard, Catherine Newton	Sunderland	Abigail Adams House.
Iunter, Robert Packard [2]	Melrose	86 Pleasant Street.
Iutchings, Kenneth Langley	Boston	35 Lincoln Avenue.
sgur, Benjamin	Dorchester	56 Pleasant Street.
zzi, Emil	South Barre	97 Pleasant Street.
ahnle, Carl George	Winthrop	97 Pleasant Street.
ohnson, Eunice Moore	Holden	Abigail Adams House.
ohnson, William Anders	Haverhill	Theta Chi.
Kane, Esther Marie	Holyoke	Abigail Adams House.
Karlson, Erick Richard	Worcester	18 Nutting Avenue.
Karlson, Josta Andrew [1]	Worcester	18 Nutting Avenue.
Karner, Lenox Stanley, Jr.	West Acton	M. A. C. Bungalow.
Keenan, John Henry [2]	Dorchester	Box 36, North Amherst.
King, Edward Albert	Granby	9 Phillips Street.
Kingsbury, Harlan Wesley	Braintree	86 Pleasant Street.
Klar, James Shepard	Springfield	42 Lincoln Avenue.
Klaucke, Elfriede	Worcester	Abigail Adams House.
Kovaleski, John Alexander	Westfield	Wildwood Cemetery Road.
Kulash, Walter Michael	Haydenville	35 Lincoln Avenue.
Ladd, Eleanor	Dalton	Abigail Adams House.
Leach, Edward Earl	Seekonk	83 Pleasant Street.
Leary, Daniel Joseph	Turners Falls	13 Phillips Street.
LeClair, Charles Alonzo	Amherst	29 Main Street.
Levereault, Philip Joseph	Willimansett	13 Fearing Street.
Machmer, Gretchen Bonine	Amherst	25 Amity Street.
Maclinn, Walter Arnold	Amesbury	6 Nutting Avenue.
Mannix, John Joseph	Holyoke	45 Fearing Street.
Marchelewicz, Joseph Ludwik	Three Rivers	9 Phillips Street.
Martin, John Graham	Springfield	Q. T. V.
Matson, William John, Jr.	Narragansett, R. I.	Care of Mrs. M. Johnson, Eames Street.
McCann, Frances Bates	Fall River	Abigail Adams House.
McIntyre, William Vincent	Clinton	44 Sunset Avenue.
McMahon, Agnes Grimes	Brighton	Abigail Adams House.
Meigs, Walter Hawkins	Westboro	15 Fearing Street.
Meiselman, Harry	Dorchester	56 Pleasant Street.
Merrill, Elisha John Neale [2]	Ware	22 Dana Street.
Michelson, George	Dorchester	56 Pleasant Street.
Miller, Charlotte Winifred	South Amherst	South East Street.
Minarik, Charles Edwin	Westfield	Wildwood Cemetery Road.
Miner, Harold Edson, Jr.	Holyoke	10 North College.
Mitchell, Bertrand Hamilton, Jr.	Norwalk, Conn.	83 Pleasant Street.
Moody, Charles William	Pittsfield	27 Fearing Street.
Moody, George Deming	North Andover	57 Lincoln Avenue.
Mucklow, Francis Alfred [2]	Windsor, Conn.	18 Nutting Avenue.
Munson, Janice	Amherst	101 Butterfield Terrace.
Murphy, Sarah Agnes	Dorchester	Abigail Adams House.
Nash, Edmond	Greenfield	9 Phillips Street.
Nelson, Harold Richmond	Framingham	22 Fearing Street.
Nichols, Raymond Elmer [2]	Reading	The Davenport.
Noyes, William Dayton	Boston	15 North College.
Ocampo, Guillermo	Colombia, S. A.	81 Pleasant Street.
O'Mara, Joseph George	South Boston	Care of W. Webb, Baker Place.
Ordway, Alfreda Lucie	Hudson	Abigail Adams House.
Palmer, James Bruce	Chester	6 Nutting Avenue.
Parker, Arthur Clough	East Lynn	13 Phillips Street.
Parker, Pearl Gladys	Hawley	37 Pleasant Street.
Pelissier, Raymond Francis	Hadley	Box 197, Hadley.
Perkins, Isabel Roberta	Worcester	Abigail Adams House.
Pike, Anita Leigh	Dorchester	Abigail Adams House.
Pineo, Victor Clifton	Hadley	21 Russell St., Hadley.
Polar, John	Acushnet	97 Pleasant Street.
Poole, Horace Lincoln	Lynn	31 North Prospect Street.
Powell, Townsend Henry	Brookfield	8 Nutting Avenue.
Prentiss, Doris Ethel	Holyoke	Abigail Adams House.
Pruyne, Granville Sherman	Pittsfield	30 Fearing Street.
Ramsdell, Eleanor Wardwell	Andover	Abigail Adams House.
Reid, Carn Rapp [2]	Brookline, Pa.	3 Hallock Street.
Richards, William Warnock	Hempstead, N. Y.	13 Hallock Street.
Riihimaki, Arthur Alexander	Quincy	9 Phillips Street.
Roach, Douglas Bryan	Provincetown	57 Northampton Road.
Rondeau, Laurence Adelard [2]	Adams	Care of W. Webb, Baker Place.
Rosenson, Herbert James	Everett	56 Pleasant Street.
Rudman, Helen Howland	Agawam	Abigail Adams House.
Runge, Paul Martin [2]	Norton	Care of W. Webb, Baker Place.
Russell, Waldo Rufus	Townsend	44 Sunset Avenue.
Sabean, Harold Cleveland	Peabody	13 Hallock Street.
Sabine, Harriet Butterfield	London, Canada	Abigail Adams House.
Schmid, Alexander August	Brookline	81 Pleasant Street.
Schuhle, John Martin	Turners Falls	13 Phillips Street.
Scott, Seymour Blois	Sharon	75 Pleasant Street.
Shea, Harold Stephen [2]	North Adams	9 Phillips Street.
Shea, William Roger	Ware	Q. T. V.

[1] Candidate for the Degree of Bachelor of Vocational Agriculture.
[2] Admitted on probation, entrance record incomplete.

Shepard, Sidney	Malden	56 Pleasant Street.
Shuman, Harold	Turners Falls	9 Phillips Street.
Sisson, Parker Lincoln	Lynn	10 Nutting Avenue.
Smith, Robert Lee	Jamaica Plain	22 Fearing Street.
Smith, William Tyler	North Brookfield	3 Hallock Street.
Snell, Eleanor Lazelle	Worcester	Abigail Adams House.
Sorton, Edgar	Northampton	54 South St., Northampton.
Soule, Harold Leroy	West Bridgewater	51 Amity Street.
Southwick, Lawrence	Leicester	10 Nutting Avenue.
Steffanides, George Fote	Boston	2 Dickinson Street.
Stensby, Leif Edward	Concord	17 Kellogg Avenue.
Stephan, Charles Philip, Jr.	Brooklyn, N. Y.	3 Hallock Street.
Stephansen, Hans Christian, Jr.	Churchville, Pa.	4 Chestnut Street.
Stewart, Malcolm Chamberlain	Needham	44 Sunset Avenue.
Stiles, Robert Edward	Amherst	122 West Street.
Stratton, Eleanor Pauline	Bridgeport, Conn.	Abigail Adams House.
Sturtevant, Ralph Francis	Halifax	21 Woodside Avenue.
Swartzwelder, John Clyde	East Lynn	15 Fearing Street.
Sylvester, George Stull	Glen Rock, N. J.	Phi Sigma Kappa.
Taft, Robert	Mendon	97 Pleasant Street.
Taylor, Fred Herbert	Groton	10 Nutting Avenue.
Taylor, John Joseph	Great Neck, N. Y.	15 Fearing Street.
Taylor, Marion Ruth	Greenfield	Abigail Adams House.
Thomas, Frank Foster	Somerville	Care of W. Webb, Baker Place.
Thompson, Edwin James [1]	Stoughton	22 Dana Street.
Thompson, Walter Earl, Jr.	Holyoke	18 Nutting Avenue.
Trow, Francis Gilman	Buckland	9 Phillips Street.
Tucker, Faith Laura	West Townsend	Abigail Adams House.
Tyler, Stanley Warren	East Lynn	4 Tyler Place.
Vogel, Ruth Marion	Holyoke	Abigail Adams House.
Walsh, Frank Joseph	Springfield	15 Phillips Street.
Ward, Willard Raymond	Brookline	18 Spring Street.
Warren, Philip Wallis	West Auburn	27 Fearing Street.
Welsh, Frederick Joseph	North Abington	45 Fearing Street.
Whitcomb, Richard Frank	Springfield, Vt.	6 Nutting Avenue.
White, Maurice Francis	Maynard	11 North College.
Whitney, Joseph Adolphus	Northampton	22 Fearing Street.
Wilcox, Joan Elizabeth [2]	Jamaica Plain	Abigail Adams House.
Wilson, Sylvia Belle	Ware	Abigail Adams House.
Wilson, William Graham	Maple Falls, Wash.	Davenport Inn.
Wood, Harold Spencer	Central Village	44 Triangle Street.
Wright, Vera Isabelle	Northfield	Abigail Adams House.
Zillman, Joseph Frank	Dorchester	5 North College.

SPECIAL STUDENTS

Belden, Stearns Newton	Bradstreet	Kappa Sigma.
Erickson, Karl Henrick	Somerville	35 Lincoln Avenue.

REGISTERED AFTER THE CATALOGUE FOR 1928 WAS PUBLISHED.

1931

Renaud, Hector Holmes	Walpole.

1932

Thompson, Edward Henry	New Brunswick, N. J.
Wood, Virginia	West Bridgewater.

SUMMARY BY CLASSES.

Class.	Men.	Women.	Total.
1930	87	28	115
1931	87	28	115
1932	123	37	160
1933	155	45	200
Specials	2	–	2
Totals	454	138	592

GEOGRAPHICAL SUMMARY.

Massachusetts	547	Louisiana	1
Maine	3	Michigan	1
New Hampshire	1	Washington	1
Vermont	2	Canada	1
Connecticut	10	England	1
Rhode Island	2	Holland	1
New York	10	Albania	1
New Jersey	5	Colombia	1
Pennsylvania	2	Russia	1
Florida	1		
		Total	592

[1] Candidate for the Degree of Bachelor of Vocational Agriculture.
[2] Admitted on probation, entrance record incomplete.

STOCKBRIDGE SCHOOL OF AGRICULTURE.

Graduates, 1929.

[erritt Lester Aseltine, Jr.	Mittineague.
ervetus Thomas Ashworth, Jr.	Westboro.
oward Dudley Barnes	Roslindale.
oseph Chisholm Baxter	Dorchester.
llen Montgomery Belden, Jr.	Springfield.
lbridge Francis Belden	Woburn.
ussell Pentecost Blackinton, Jr.	Chepachet, R. I.
rthur Ramsdale Blackwell	Wellesley Hills.
loyd Meserve Boothby	Randolph.
obert Braun	Holliston.
ames Francis Brown	Lowell.
Vinsor Cargill Brown	North Attleboro.
liver Franklin Cheney	Framingham.
Ierton Ashley Cottrell	Middlefield.
Vilfred Louis Coutu	North Cambridge.
)enis Crowley, Jr.	Quincy.
ysleford Arthur Dibble	Wilbraham.
lara Louise Dillaway	Newton Highlands.
Iarold Max Engelmann	Pittsfield.
homas Lewis Ewart	Newton Highlands.
ohn Martyn Eyberse	Manchester.
awrence James Fahey	Easthampton.
harles Joseph Flavin	Whately.
harles Wilfred Fletcher	Rehoboth.
aul Lawrence Franklin	Springfield.
William Brown French	Granby.
lbert Henry Fuller	Ludlow.
dward Francis Gallagher	Lenox.
Henry Graf, Jr.	Newburyport.
Kenneth Batchelder Graves	Conway.
Albert Melville Greene	Ashland.
Bertrand Augustus Hall	Amherst.
John Woodbury Hall	Ballard Vale.
Henry John Hartness	Sutton.
Edward Charles Hempel, Jr.	Blackstone.
Margaret Herron	Greenfield.
William Tolle Hermann	Harvard.
George Wilmarth Hero	Westboro.
Edward Pickering Hobart	Duxbury.
Herman Francis Hoyt	Newton.
Gordon Chesley Hulbert	Holliston.
Elliott Proctor Joslin, Jr.	Oxford.
Paul Haynes Kelley	Orange.
Earle Spencer Kendrick	Everett.
Lewis Emory King	North Brookfield.
Robert Arthur Leland	East Bridgewater.
George Thomas Lincoln	Barre.
Emilio Anthony Masciocchi	Roxbury.
Walter Howard Mayo, Jr.	East Orleans.
Frank Anthony Mongillo	Southington, Conn.
William McConvill	New Bedford.
Leon Holcomb Noble	East Hartford, Conn.
Gardner Seabury Osgood	North Dartmouth.
Leonard Raymond Parkinson	Springfield.
Stillman Harding Parks	Gloucester.
Frank Reddick Perkins	Lexington.
Noel Cornell Phelps	Lexington.
Richard Staigg Philbrick	Woburn.
Clarence Albert Pratt	Bernardston.
Harry Dumont Quick	Dighton.
William Edward Robison, Jr.	Holyoke.
Glenn Hay Roundy	North Billerica.
Nicholas Belmont Russo	Fitchburg.
Frances Sherburne	Concord.
Richmond Morse Sherman	Southbridge.
Austin James Smith	South Londonderry, Vt.
John Francis Smith	Westboro.
Alwyn Gayner Snell	Brockton.
Thornton Stevens	Norwood.
Agnes Nora Sullivan	Palmer.
John Joseph Sullivan	Salem.
Joseph Frates Sylvia	Mattapoisett.
Milton Franklin Warren	New Bedford.
Gordon Worth Weston	Cambridge.
Albert Howard Whelan	Brookline.
James Henry Woodger	Sheffield.
Robert Augustus Young	Norton.
Charles Wilson Parker (as of the Class of 1926)	Belmont.

Class of 1930.

Arnott, William Henry	Fitchburg	116 Pleasant Street.
Avery, Willard Wendell	East Kingston, N. H.	Kolony Klub.
Bailey, Harold Frederick	Southboro	18 Cottage Street.
Barr, Richmond Cushman	Worcester	Kolony Klub.
Beaumont, Mary	Saxonville	Draper Hall.
Becker, Charles Young	Westport, Conn.	42 McClellan Street.

Bolles, Edgar Stanley, Jr.	Monument Beach	42 McClellan Street.
Bower, William Critchley	Methuen	A. T. G., North College.
Brainard, Floretta Ten Broeck	West Springfield	Draper Hall.
Brookings, Eugene Sturgis	West Newton	A. T. G., North College.
Brown, Ralph Leonard	Portsmouth, N. H.	109 Butterfield Avenue.
Burkhardt, George E.	Worcester	Baker Lane, Care of Mrs. Webb.
Byron, John Stephen	Hadley	9 Phillips Street.
Caldwell, Sanborn Ames	Lynnfield	Kolony Klub.
Carlon, John Joseph	Northampton	Northampton.
Caswell, Richard Burrell	Lakeville	3 McClure Street.
Chadwick, Richard Poor	West Boxford	35 Lincoln Avenue.
Chapin, Samuel Clarence, Jr.	East Longmeadow	Cosby Ave., Care of Mrs. Pickering.
Cleary, Joseph Robert	Lynn	Baker Lane, Care of Mrs. Dillingham.
Couture, Herman	Warren	10 McClellan Street.
Coyle, Joseph Henry	Somerville	66 Lincoln Avenue.
Crockett, Elmer Matthews	Rockport, Maine	42 McClellan Street.
Curran, James Henry	Danvers	43 High Street.
Curran, Thomas Edward	Danvers	43 High Street.
Cutrumbes, Arthur John	Dracut	Colonial Inn.
Derby, Charles Henry	Paxton	52 Lincoln Avenue.
Dimock, Everett Tatman	Oxford	108 Pleasant Street.
Donnis, Joseph Donald	Hatfield	McClure Street, Care of Mrs. Linehan.
Doucette, Francis Anthony	East Braintree	A. T. G., North College.
Durkin, Harold	Waltham	Kolony Klub.
Eva, William James, Jr.	Amherst	84 South Pleasant Street.
Felch, Norman Seward	Salisbury	A. T. G., North College.
Feltham, Doris Leana	Springfield	Draper Hall.
Fox, Katherine Taber	Cambridge	Draper Hall.
Fox, Nelson Bernerd	Lowell	18 Cottage Street.
Frost, Gardner Lane	Lexington	Kolony Klub.
Godin, Edward	Hatfield	Hallock Street, Care of Mrs. J. Trainor.
Goduti, Joseph Lawrence	Somerville	66 Lincoln Avenue.
Gottfried, Helen	Tryon, N. C.	46 McClellan Street.
Hakkinen, Arvo Otto	Gardner	A. T. G., North College.
Haley, Herbert Francis	Orange	89 Pleasant Street.
Hart, Francis Edward	Whitman	12 Cottage Street.
Hartley, Winston J.	Waltham	9 Fearing Street.
Hastings, Judson Worthington	Agawam	A. T. G., North College.
Hebblethwaite, Sumner W.	Islington	50 Sunset Avenue.
Hill, Edwin Wilpas	Gardner	A. T. G., North College.
Hill, Jason Hartwell	North Brookfield	Box 36, North Amherst.
Hohman, Charles Francis	Abington	Kolony Klub.
Hodges, William Belcher	Stoughton	A. T. G., North College.
Holt, Chester Whitmore	Georgetown	7 McClellan Street.
Jubenville, Alfred	Hatfield	McClure Street, Care of Mrs. Linehan.
Kastberg, Theodore	Worcester	10 McClellan Street.
Keene, Edwin Emil	Roslindale	9 Fearing Street.
Kinsman, Richard McLearn	Middleboro	108 Pleasant Street.
Knight, Francis Meredith	Westhampton	4 Hallock Street.
Lassman, Nathan	Haverhill	15 Cottage Street.
Lee, Richard Henry	Northampton	Northampton.
Leonard, Kenneth Chester	Abington	A. T. G., North College.
Lewis, Walden P.	South Braintree	62 Pleasant Street.
Liukas, Arne Victor	Gardner	A. T. G., North College.
Lynn, Allan William	Brockton	13 Hallock Street.
Lyons, John Carleton	Putney, Vt.	A. T. G., North College.
MacGibbon, Hugh Ruyter	Northfield, Vt.	Kolony Klub.
Mann, Robert Jerome	Worcester	Kolony Klub.
McCoy, Samuel Leon	Roxbury	18 Spring Street.
McGrath, Allan Stanford	Dedham	10 McClellan Street.
Messier, William Edward	North Adams	73 Pleasant Street.
Milligan, Edwin	South Groveland	15 Cottage Street.
Milner, Charlotte Miriam	Marshfield	Draper Hall.
Mintz, Sarah Frances	Gloucester	Draper Hall.
Morrill, Lester Trowbridge	Brockton	Mt. Pleasant, Care of Prof. Sears.
Mosher, Earle Benjamin	Worcester	7 McClellan Street.
O'Grady, Francis John	Milford	12 Cottage Street.
Oksanen, Arne Edward	Fitchburg	A. T. G., North College.
Palmer, Allison Wesselhocft	Braintree	Baker Lane, Care of Mrs. Dillingham.
Peabody, Charles Roswell	Gorham	7 McClellan Street.
Phelon, Arthur Nelson	Granville	Kolony Klub.
Putnam, Clyde Havens	Sutton	18 Nutting Avenue.
Quick, Norman B.	West Springfield	75 Pleasant Street.
Rafkin, Barney	Brockton	13 Hallock Street.
Rich, Howard Lewis	Athol	108 Pleasant Street.
Rindge, Harold Raymond	Palmer	7 McClellan Street.
Roberts, Clinton Scott	Bristol, Conn.	A. T. G., North College.
Rosenthal, Robert	West Springfield	86 Pleasant Street.
Rounseville, Leroy Lincoln	Middleboro	Box 36, North Amherst.
Salo, Victor V.	Millbury	84 Pleasant Street.
Schwartz, Joseph Pinkus	Revere	Davenport Inn.
Shats, Alfred Julius	West Hanover	18 Cottage Street.
Shearer, Frederick Robert	South Hadley Falls	South Hadley Falls.
Sherman, Elizabeth	North Marshfield	Draper Hall.

Smith, A. Willard	Northampton	Northampton
Smith, Christopher Frederick	Holyoke	42 Cottage Street.
Smith, Cornelia M.	Winchester	Draper Hall.
Sprague, Milton Cornel	Springfield	81 Pleasant Street.
Stone, Donald Henry	Shrewsbury	Baker Lane, Care of Mrs. Dillingham.
Taft, William Lamb.	Whitinsville	A. T. G., North College.
Tamm, Agnes K.	Astoria, N. Y.	46 McClellan Street.
Taylor, Edmund Fernald	Amesbury	18 Cottage Street.
Tracy, Richard Hadley	Windsor, Vt.	4 Hallock Street.
White, John J.	Fall River.	17 Kellogg Avenue.
White, Lincoln	Abington	Kolony Klub.
Wilcox, Keith Hinton	Port Leyden, N. Y.	84 Pleasant Street.
Wilson, Douglas Craig	Bolton	Kolony Klub.
Wood, Edwin Porter	Dalton	R. F. D. No. 3, Box 83, Care of Mr. Newlon.
Woodward, Clinton E.	Taunton	17 Kellogg Avenue.
Worthington, Ernest Howard	Auburn	Kolony Klub.
Zimmerman, Henry Adam	Auburn	Kolony Klub.
Ziomek, Joseph V.	Amherst	R. F. D. No. 3, Box 111C.

CLASS OF 1931.

Ahrens, Alfred Herman	Bronx, N. Y. C.	3 McClure Street.
Allen, Stuart Harlow	Shrewsbury	8 Kellogg Avenue.
Andrews, Warner Childs	Watertown	12 Chestnut Street.
Baird, William Miller	Summit, N. J.	83 Pleasant Street.
Bairstow, Harry Joseph	Malden	Baker Lane, Care of Mrs. Dillingham.
Baker, Laurance Richardson	East Bridgewater	Colonial Inn.
Bancroft, Margaret Josephine	Nashua, N. H.	Draper Hall.
Barber, George Albert	Somerville	25 Gray Street.
Bell, Raymond Earl	Reading	12 Chestnut Street.
Billman, John Vincent	Milton	3 McClure Street.
Blatchford, Lawrence Eaton.	Attleboro	33 Cottage Street.
Boardman, Edgar Shears	Sheffield	4 Chestnut Street.
Brown, Stuart Gilmore	North Attleboro	33 Cottage Street.
Brox, John	Dracut	3 McClure Street.
Buell, Harry Clemens	Petersham	Hillside Avenue, R. F. D. No. 126.
Burbank, Norman Ballou	West Somerville	35 Lincoln Avenue.
Burke, Thomas Francis	Woburn	33 Cottage Street.
Bush, Ralph Loomis	Holyoke	13 Hallock Street.
Carroll, John Paul	Salem	35 Lincoln Avenue.
Chase, Lyman Matthew	Littleton	66 Lincoln Avenue.
Cobb, John Francis	East Boston	15 Cottage Street.
Coleman, Rutherfoord	Roanoke, Va.	Cosby Avenue, Care of Mrs. Pickering.
Coolidge, Frank Arthur, Jr.	Barre	North Pleasant Street. Care of Mrs. Carey.
Coville, Richard Prentiss	Cummaquid	9 Phillips Street.
Crocker, Richard Cushing	South Duxbury	Baker Lane, Care of Mrs. Webb.
Crocker, Robert Sears	South Duxbury	Baker Lane, Care of Mrs. Webb.
Dineen, Christopher Joseph	West Roxbury	14 McClellan Street.
Doane, George Hubbard	North Brookfield	Hitchcock Street, Care of Rev. John A. Hawley.
Dostol, Edward Joseph	Northampton	Northampton.
Duffill, John Winthrop	Melrose	Davenport Inn.
Duponte, Charles William	Nantucket	30 North Prospect Street.
Dykman, Robert William	Westport, Conn.	25 Gray Street.
Elton, Richard McKenzie	Hampton Falls, N. H.	30 North Prospect Street.
Farnham, Thomas Newell	Shoreham, Vt.	Care of Mr. Packard, North Amherst.
Faulk, Wesley Snow	Brockton	60 Pleasant Street.
Fenton, Francis Xavier	West Roxbury	16 Hallock Street.
Fifield, Lewis Henry	Norwood	30 North Prospect Street
Fish, Ozro Meacham	Concord	45 Fearing Street.
Foster, Philip Woolsey	Sherborn	Box, 8, Stockbridge Hall.
Foskit, George Leonard	Three Rivers	Baker Lane.
Glidden, Robert Norwood	Middleboro	75 Pleasant Street.
Greene, Sheffield, Jr.	Westerly, R. I.	Cosby Avenue, Care of Mrs. Pickering.
Greene, William Templeton	Lowell	22 Fearing Street.
Griffin, Michael Joseph	Amherst	3 Shumway Street.
Haley, Horace Stanley, Jr.	Boston	Baker Lane, Care of Mrs. Dillingham.
Hammerstrom, Iver William	Worcester	84 Pleasant Street.
Hare, John Wells	Springfield	17 Kellogg Avenue.
Hatheway, Frank Wilson	Amherst	Draper Hall.
Henry, Ralph	Malden	50 Sunset Avenue.
Hildreth, Earl Joseph	Worcester	28 Pleasant Street.
Hoyt, George Raymond	Merrimac	13 Phillips Street.
Hueg, Harold Cleveland	Wellesley	30 North Prospect Street.
Hulbert, Howard Marshall	Holliston	Baker Lane, Care of Mrs. Dillingham.
Ives, Royal Edward	Amherst	R. F. D. No. 1, Box 125.
Jones, Edward George	Ashland	17 Kellogg Avenue.
Kalashian, Harold George	Worcester	Cosby Avenue, Care of Mrs. Pickering.

Keady, Joseph Francis	Rockland	Baker Lane, Care of Mrs. Webb.
Keene, Clyde Merton	Concord	17 East Pleasant Street.
Kellogg, Richard Alvin	Feeding Hills	33 Cottage Street.
Lee, John Francis	Norwood	14 McClellan Street.
Little, John Willer	Marshfield Hills	28 Pleasant Street.
Lund, Harold Clifford	Shrewsbury	8 Kellogg Avenue.
Maroney, Donald Thomas	Uxbridge	7 Phillips Street.
Mauro, Arthur Artillio	Marlboro	Meadow Street, Care of Mr. Packard.
Mongillo, Leonard	Southington, Conn.	Hillside Avenue, No. 126.
Moore, Arthur Phillips	West Peabody	30 Fearing Street.
Moulton, Parker Edward	Peabody	Baker Lane, Care of Mrs. Webb.
Murray, Henry Stephen	Concord	1 Cottage Street.
McCaffrey, Thomas Frank	Boston	1 Cottage Street.
McCarthy, George W.	Northampton	Northampton.
McKechnie, Robert Melton	Natick	81 Pleasant Street.
McWilliams, Arthur Gilbert	Hackensack, N. J.	25 Gray Street.
Nelson, Alfred Warran	Randolph	1 Cottage Street.
Nelson, Lawrence Ingvall	Petersham	Hillside Avenue, R. F. D. No. 126.
Niles, Sherman Murray	Pownal, Vt.	3 McClure Street.
Perry, Arthur Hudson	Barre, Vt.	Baker Lane, Care of Mrs. Dillingham.
Petersen, Ernest Arthur	Framingham	17 East Pleasant Street.
Peterson, William Bertil	Lexington	4 Chestnut Street.
Pickard, Hobart Leander	Littleton	Baker Lane, Care of Mrs. Dillingham.
Pilling, Thomas Linwood	Worcester	46 Pleasant Street.
Proctor, Donald Powers	Spencer	3 Hallock Street.
Purdy, Harris Henry	Merrimac	13 Phillips Street.
Putnam, Ralph Matthew	New Bedford	30 North Prospect Street.
Reed, Francis George	Portland, Me.	Cosby Avenue, Care of Mrs. McCleary.
Rice, Harold Francis, Jr.	Norwood	Cosby Avenue, Care of Mrs. Pickering.
Roberts, Clayton Norman	Medfield	30 North Prospect Street.
Robertson, Charles Albert	Somerville	Cosby Avenue, Care of Mrs. McCleary.
Rodman, Elizabeth	Wickford, R. I.	Draper Hall.
Rogers, Eliot Francis	West Newton	129 Butterfield Avenue.
Seaver, Margarita	Buzzards Bay	Draper Hall.
Shibles, Clinton Andrew	Rockport, Maine	10 McClellan Street.
Shumway, Wilbur Eberhardt	Springfield	7 Phillips Street.
Simonds, Raymond Leo	Athol	Baker Lane, Care of Mrs. Webb.
Smith, A. Weston	Bronxville, N. Y.	Kolony Klub.
Sonborger, Isabel Tyler	West Springfield	30 Lincoln Avenue.
Stalker, Barbara Alice	Framingham	Draper Hall.
Sundberg, Lawrence Elroy	Brockton	30 North Prospect Street.
Swett, Josiah Dodge	Bloomfield, Conn.	3 Nutting Avenue.
Taber, Robert Ellis	New Bedford	30 North Prospect Street.
Twohig, James Francis	Springfield	3 Nutting Avenue.
Twohig, William Patrick	Springfield	3 Nutting Avenue.
Vik, John Henry	Wakefield	29 Lincoln Avenue.
Warren, Albert Francis	Medford	25 Gray Street.
Watt, Lewis Cavine	Somerville	Baker Lane, Care of Mrs. Webb.
Watts, George Frederick	Whitman	25 Gray Street.
Webb, William Kenneth	Milford	12 Cottage Street.
Webster, Howard Sheldon	Haverhill	11 Cottage Street.
Weeman, Walter Russell	Middleboro	75 Pleasant Street.
Wheaton, Lloyd Ellsworth	North Dartmouth	Hillside Avenue, Care of Miss Magee.
Whitney, Oakley Fayne	Orange	Baker Lane, Care of Mrs. Webb.
Whittington, Charles Richard	New York City, N. Y.	11 Cottage Street.
Wilcox, Earle Crandel	Farmington, Conn.	25 Gray Street.
Witt, Louis Alton	North Brookfield	3 Hallock Street.
Woodbury, Richard Emerson	Fitchburg	66 Pleasant Street.

WINTER SCHOOL, 1929.

Barber, A. Mildred	Brookline.
Baylies, Elizabeth A. (Mrs.)	Taunton.
Baylies, Walter R.	Taunton.
Blake, Roy H.	Portsmouth, N. H.
Bohne, Charles O., Jr.	Louisville, Ky.
Burkhardt, Harry	Rocky River, Ohio.
Cabral, Emanuel E.	Taunton.
Callahan, Thomas	Dracut.
Chandler, Harry P.	Northampton.
Davis, John	Worcester.
Deckert, Richard	Plantsville, Conn.
Diette, Orvide H.	Orleans, Vt.
Dwight, Joel H.	West Hatfield.
Dwight, Myron H.	West Hatfield.
Eaton, Arthur W.	Orange.
Fifield, Lewis H.	Norwood.
Frye, W. Russell	Medford.

Gardiner, Harriet W.	Newton Centre.
Gelinas, J. Hermann	Biddeford, Me.
Green, Albert H., Jr.	Shrewsbury.
Greene, Louise D.	Cambridge.
Gross, Sam D.	Marshfield Hills.
Hamill, Cecil E.	Sherborn.
Hamlin, Ada C. (Mrs.)	Amherst.
Hamlin, William R.	Amherst.
Harlachor, Hans.	Ridgewood, N. J.
Hawthorne, Earl	Springfield.
Holland, Mary J.	Waltham.
Jorgenson, Kristian	Brooklyn, N. Y.
Kidder, Guy E.	Clinton.
Kidder, Victor L.	Gorham, N. H.
Lindsay, Alexander	Worcester.
Lowe, James	Byfield.
McGowan, Joseph	Dedham.
Mitchell, Charles E.	North Scituate.
Moquinn, George	Bristol, Conn.
Mumford, William C.	Roanoke, Indiana.
Ogg, William, Jr.	Worcester.
Poe, James	Sterling.
Putnam, Havard A.	Springfield.
Rogers, Carl J.	Lee.
Ross, Gordon K.	West Bridgewater.
Rounsevell, W. Scott	East Bridgewater.
Samuelian, Albert Y.	Dorchester.
Saurer, Herman	Fort Wayne, Indiana.
Shores, Paul D.	Northampton.
Shurbert, Richard H.	North Falmouth.
Stevens, Theodore R.	Amesbury.
Stone, Frederick I.	Shrewsbury.
Stromwall, Alton E.	Bridgewater.
Wise, Robert	East Boston.
Woodworth, David O.	West Lynn.
Zimmerman, Donald R.	Framingham.

Summer School, 1929.

Graduate Students. (See list on page 129.)

Undergraduate Students.

Andrews, John A.	West Boxford.
Ashman, Elmore G.	Walpole.
Baker, Dorothy C.	Waban.
Baker, Dorothy M.	Millers Falls.
Barlow, Helen W.	Amherst.
Beauchemin, Marie D.	Holyoke.
Bennett, J. Stanley	Danvers.
Bergan, Mary V.	Northampton.
Boron, Mella M.	Holyoke.
Brockway, Kathleen	South Hadley.
Brown, Lena	Worcester.
Brown, Mildred S.	North Amherst.
Brown, Ruth E.	Northampton.
Brown, Thurl D.	Danvers.
Burns, Florence L.	Rowley.
Cain, George H.	Braintree.
Cameron, Jean	Lowell.
Carmody, May F.	Belchertown.
Casey, Alma M.	Springfield.
Casey, Margaret M.	Dorchester Center.
Chadwick, Alan W.	Worcester.
Champagne, Marguerite	Holyoke.
Chapin, Marion E.	Chicopee.
Chapman, Gean M.	Bradford.
Clapp, Helen I.	Northampton.
Costello, John P.	Franklin.
Cowan, Elizabeth B.	Amherst.
Cramer, Dorothy M.	Holyoke.
Crowley, Katherine	Amherst.
Crowley, Mary E.	Westhampton.
Cutting, Alice A.	Waltham.
Cutting, Mary E.	Waltham.
Davidson, Katharine S.	Chicago.
Davis, Arnold M.	Boston.
Dean, Mary S.	Brockton.
Dickinson, Mabel H.	Holyoke.
Donely, Marian T.	Boston.
Donnelly, Ann H.	Jamaica Plain.
Dover, Evelyn	Methuen.
Flaherty, Alice M.	Belchertown.
Flood, George M.	North Adams.
Fraser, Richard A.	Lowell.
Goodnow, Robert G.	Mendon.
Gordon, Virginia	Amherst.
Grenier, Geraldine	Northampton.
Griffin, J. Harold	Easthampton.
Griffiths, Margaret A.	Washington (Seattle).
Gula, Joseph	Bondsville.
Hanifin, Agnes	Belchertown.

Hanifin, Irene E.	Belchertown.
Hanslick, Otis	Somerville.
Harrington, Mrs. Ida S.	Providence, R. I.
Harwood, Mrs. Ann W.	Springfield.
Hatch, Ruth F.	North Amherst.
Hayes, Ernest L.	Milton.
Hill, Priscilla E.	Worcester.
Hinchey, Anne E.	Palmer.
Hoffman, Anne N.	Holyoke.
Holway, Alfred H.	Holyoke.
Howard, Lucius A.	Ridgewood, N. J.
Howe, Florence I.	Leominster.
Howe, Jenabelle D.	North Amherst.
Hurley, Catherine A.	Marlboro.
Johnston, Robert A.	Rockland.
Keedy, Flora B.	Amherst.
Keep, Myra G.	Monson.
Kennedy, Anna M.	Westfield.
Kennedy, Margaret W.	Westfield.
King, Kathleen G.	South Amherst.
Knight, Elva E.	Amherst.
Labarge, Robert R.	Holyoke.
Lane, Margaret F.	Leominster.
Loomis, Elizabeth K.	Greenfield.
Loomis, Ruth G.	Easthampton.
Loveland, Elsie I.	Greenfield.
Lyman, Josephine B.	Northampton.
Lyman, Ruth	North Adams.
Lyons, Ella R.	Dorchester.
Machmer, Gretchen B.	Amherst.
MacLean, Marian E.	Waverley.
Mahar, Mildred	Holyoke.
Maloney, Grace E.	Northampton.
Marinaro, Josephine M.	West Springfield.
Mason, Mildred C.	Conway.
McCarthy, Alice	Brookline.
McCarthy, Margaret L.	Brookline.
McKay, Catherine M.	Newtonville.
McKenna, Mrs. Mary L.	New Bedford.
Merriam, Mildred E.	Ashburnham.
Miller, Hazel E.	Beverly.
Moline, Jessie G.	Sunderland.
Morgan, Isabel E.	Schenectady, N. Y.
Morris, Lillian J.	Holyoke.
Moynahar, Eileen V.	Holyoke.
Nott, G. E.	Brookfield.
O'Connor, Margaret A.	Northampton.
O'Donnell, Mary B.	Easthampton.
Parker, Catharine S.	Attleboro.
Partenheimer, Margaret	Northampton
Pearson, Katharine	Newburyport.
Pollard, Ruth	Northampton.
Porter, Katharine W.	Canton.
Powers, Marcella K.	Florence.
Putnam, 2d, Edwin H.	Lyndeboro, N. H.
Putnam, Mrs. Vera S.	Greenfield.
Readio, Marian A.	Florence.
Ronka, Lauri S.	Gloucester.
Roy, Pauline M.	Hinsdale.
Rutan, Huntington	North Hadley.
Sanford, Gail F.	Springfield.
Saltman, Rose	Holyoke.
Shea, Anna L.	Springfield.
Shepherd, Marion	Cambridge.
Stalker, Ruth E.	Holyoke.
Stoddard, Herbert T.	Cohasset.
Taylor, Gladys F.	Belmont.
Taft, Jesse A.	Mendon.
Thacher, Hilda J.	North Dartmouth.
Thomas, Hazel L.	Amherst.
Thomas, Helen R.	Amherst.
VanLeer, Hans L.	Hilversun, Holland.
Warner, Lulu H.	Amherst.
Warren, Dorothy	Amherst.
Wheeler, Florence E.	Rutland.
Wilk, Joseph Addison	Adams.
Williams, Alice M.	Lynn.
Wood, Priscilla G.	West Bridgewater.
Wright, Mrs. Denise	Amherst.
Wright, Lela E.	Ludlow.

SUMMARY OF SHORT COURSE ENROLLMENT.

	Men.	Women.	Total.
Stockbridge School of Agriculture:			
Second year	98	10	108
First year	109	5	114
Winter School, 1929	47	6	53
Summer School, 1929 (exclusive of Graduate Students)	27	102	129
Totals	281	123	404

DEGREES CONFERRED — 1929.

DOCTOR OF PHILOSOPHY (PH.D.)

Vincent, Clarence Cornelius, B.S., M.S., Oregon State Agricultural College, M.S., Cornell University Moscow, Idaho.

MASTER OF SCIENCE (M.S.)

France, Ralph Lyle, B.S., University of Delaware Amherst.
Kakavas, James Christos, B.S., Massachusetts Agricultural College . . Amherst.
Pettee, Donald Abner, B.S., University of New Hampshire Francestown, N. H.
Seymour, Frank Conkling, A.B., Harvard University, B.D., Union Theological Seminary North Amherst.
Wildon, Carrick Earl, B.S., Massachusetts Agricultural College . . . Kingston, R. I.

BACHELOR OF SCIENCE (B.S.)

Adams, Harold Sweetnam Whitinsville.
Alberti, Francis Daniels Greenfield.
Allen, Olive Elizabeth Flushing, N. Y.
Anderson, Andrew Bremer Hudson.
Arnurius, Armond Lovell East Orange, N. J.
Bailey, Stanley Fuller Middleboro.
Barr, Charles Wesley Pittsburgh, Penn.
Bartlett, Irene Lawrence Rowley.
Bertenshaw, Edith Louise Fall River.
Black, Chesley Leman Reading.
Blaisdell, Matthew Louis North Amherst.
Bond, James Eaton, Jr. South Lancaster.
Bowie, Robert Lester. East Milton.
Burgess, Emory Dwight Melrose Highlands.
Caldwell, Eleanor Amherst.
Canney, George Gridley South Hadley.
Carruth, Laurence Adams Worcester.
Chadwick, John Shore Worcester.
Chapin, Alice Streeter Sheffield.
Cleaves, Charles Shepley Gardner.
Copson, Harry Rollason Easthampton.
Crowley, Dennis Michael Boston.
Crowley, Francis Jeremiah Amherst.
Davis, Donald Austin Bedford.
Devine, John Warren Arlington.
Dyer, Arnold Walton Falmouth.
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Flint, George Bemis Lincoln.
Fonseca, Martin Goodman Brighton.
Fontaine, Mildred Fall River.
Frost, Charles Austin Belmont.
Gifford, Charles Edwin Sutton.
Hawley, Guila Grey Westfield.
Hilbert, Alfred George Chicopee Falls.
Hintze, Roger Thomas Amherst.
Holland, Bertram Holbrook Millis.
Horan, Timothy Joseph Whitinsville.
Howe, Frank Irving, Jr. Norfolk.
Hunter, Walter Gordon South Sudbury.
Huss, Miriam Hall Newton Center.
Isham, Paul Dwight Hampden.
Johnson, Alice Luvanne Holden.
Johnson, Clifton Russell Worcester.
Jones, Leroy Osgood Greenfield.
Kane, Mary Catherine Holyoke.
Kay, John Reid Boston.
Kelley, Charles Edward Dalton.
Kimball, John Adams Littleton.
Kreienbaum, Roman Albert Bridgewater.
Lynch, Elizabeth Anne Easthampton.

Marsh, Kendall Howe	Holden.
McKittrick, Kenneth Fraser	Boston.
Mills, Taylor Mark	Newtonville.
Morrison, Leonard William	Monson.
Nash, Robley Wilson	Abington.
Nichols, Edward Holyoke	Montpelier, Vt.
Nitkiewicz, Boleslaw	Holyoke.
Packard, Faith Evelyn	Windsor.
Parrish, Ruth Harriet	Great Barrington.
Patch, Eldred Keene	Stoneham.
Patterson, Jane	Amherst.
Pease, Holton Stebbins	Hampden.
Perkins, Esther Janet	Easthampton.
Perry, Kenneth William	Holliston.
Plumer, Paul Raymond	Adams.
Proctor, Harriet Ellice	South Weymouth.
Prouty, Earle Clinton	Monson.
Rees, Robert Drake	Pepperell.
Richardson, Evan Carleton	Millis.
Robertson, William Brunner	Port Chester, N. Y.
Rudquist, Birger John	Boston.
Sargent, Carmeta Elizabeth	Shrewsbury.
Sargent, Leonard Everett	Greenfield.
Shuman, Ernest Clark	Malden.
Slack, Grace Gertrude	Allston.
Smith, Bessie May	West Somerville.
Smith, Charles James, Jr.	North Wilmington.
Snell, Robert Sinclair	Southbridge.
Southwick, Walter Edward	Clinton.
Steere, Phillips Bradley	Chepachet, R. I.
Steinbugler, Elizabeth Ann	Brooklyn, N. Y.
Sullivan, John Ayer	Medford.
Tarr, Roy Simpson	Gloucester.
Thayer, Frederick Daniels, Jr.	Shrewsbury.
Tourtellot, Roger Sampson	Providence, R. I.
Trevett, Moody Francis	Milford.
Vartanian, Dickran	Springfield.
Walkden, Charles Edward	Swansea.
Webber, Dana Otis	Montague.
Whitten, Russell Rutherford	Melrose Highlands.
Whittle, Doris Evelyn	Worcester.
Williams, Lloyd George	Pittsfield.
Winton, Alexander Charles	Springfield.
Woodbury, John Sargent	Fitchburg.
Young, Prescott Davenport	North Grafton.
Zielinski, John Blaise, Jr.	Holyoke.

Bachelor of Vocational Agriculture (B.Voc.Agri.)

Adams, Stephen	Easthampton.
Coukos, Andrew	Lynn.
Edson, William Gordon	East Braintree.
Lyman, Warren Hillsgrove	Florence.
Sivert, Gladys Elizabeth	Worcester.

HONORARY

Doctor of Laws (LL.D.)

Wheeler, William, B.S., Massachusetts Agricultural College . . . Concord.

Doctor of Science (D.S.)

Plumb, Charles Sumner, B.S., Massachusetts Agricultural College . . Columbus, Ohio.

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MASSACHUSETTS
AGRICULTURAL EXPERIMENT STATION

BULLETIN No. 260 MARCH, 1930

Annual Report

For the Fiscal Year Ending Nov. 30, 1929

The main purpose of this report is to provide an opportunity for presenting in published form, recent results from experimentation in fields or on projects where progress has not been such as to justify the general and definite conclusions necessary to meet the requirements of bulletin or journal.

Requests for Bulletins should be addressed to the

AGRICULTURAL EXPERIMENT STATION,
AMHERST, MASS.

MASSACHUSETTS AGRICULTURAL EXPERIMENT STATION

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	Term Expires
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Arnold, Sarah Louise, Lincoln	1930
Frost, Harold L., Arlington	1931
Richardson, Carlton, D., West Brookfield	1932
Russell, Howard S., Waltham	1936
Gilbert, Arthur W., Belmont, *State Commissioner of Agriculture, ex officio*	

Experiment Station Staff, December, 1929

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Sievers, Fred J., Director — Kenney, Fred C., Treasurer

Lindsey, Joseph B., Vice-Director — Church, Lucia G., Secretary

Gaskill, Edwin F., Assistant to the Director

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*Cance, Alexander E., Agricultural Economics
*Chenoweth, Walter W., Horticultural Manufactures
Doran, William L., Botany
Fellers, Carl R., Horticultural Manufactures
*Fernald, Henry T., Entomology
*Foord, James A., Farm Management
*Frandsen, Julius H., Dairy Manufactures
*†Franklin, Henry J., Cranberries
*Gage, G. Edward, Bacteriology
*Gaskill, Edwin F., Station Service
*Graham, John C., Poultry Husbandry
*Gunness, Christian I., Agricultural Engineering and Meteorology
*Haskins, Henri D., Fertilizer Law
Hays, Frank A., Poultry Husbandry
Holland, Edward B., Plant and Animal Chemistry
Jones, John P., Agronomy
*Lentz, John B., Veterinary Science
Lindsey, Adrian H., Agricultural Economics
*Lindsey, Joseph B., Plant and Animal Chemistry
Morse, Fred W., Plant and Animal Chemistry
*Osmun, A. Vincent, Botany
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*Smith, Philip H., Feed, Dairy and Seed Laws
Van Meter, Ralph A., Pomology
Van Roekel, Henry, Veterinary Science
*Waugh, Frank A., Vegetable Gardening
*Wood, Basil B., Library

Archibald, John G., Plant and Animal Chemistry
Bailey, John S., Pomology
Bourne, Arthur I., Entomology
Bullis, Kenneth L., Veterinary Science
*Davies, Esther, Home Economics Research
DeRose, H. Robert, Fertilizer Law
Dunlap, Glenn L., Veterinary Science
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‡Guba, Emil F., Botany
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Kuzmeski, John W., Feed Law
McLaughlin, Frederick A., Feed Law
Mack, Merrill J., Dairy Manufactures
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Rozman, David, Agricultural Economics
‡Tiedjens, Victor A., Vegetable Gardening
‡Whitcomb, Warren D., Entomology
Wright, Kenneth E., Dairy Manufactures
Zielinski, John B., Jr., Fertilizer Law

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Ball, Alyn S., Botany
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*Felton, F. Ethel, Editor
Howard, James T., Feed, Fertilizer and Dairy Laws
Hughes, Mary C., Pomology
†Kelley, Joseph L., Cranberries
Miner, Gladys I., Botany
Sanborn, Ruby, Poultry Husbandry
Sherburne, Ruth E., Agricultural Economics
Shilling, Katherine E., Agricultural Economics
Snell, Moses E., Agronomy

*In Charge.
†At East Wareham.
‡At Waltham.

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ANNUAL REPORT OF THE MASSACHUSETTS AGRICULTURAL EXPERIMENT STATION—1929

INTRODUCTION

F. J. Sievers, Director

With the rapid industrial changes and developments which have been especially evident during the last half century throughout many portions of the world, and particularly in this country, an increasing portion of the consuming public has become farther removed from its direct dependency upon products of the farm. Prior to this period of marked industrial progress, or evolution, the difficulty of wresting the products of agriculture from the soil and of preparing them for use was so pronounced that it required practically all of the labor of our entire employed population. The farm and the home furnished the main market for the employment of labor; and the demands of the average consumer, beyond the bare necessities of life, were comparatively few. This applied especially to those demands that involved cash expenditures. The expenses and cash outlays for most farm practices were not considered sufficiently significant to make it necessary to keep farm accounts or to determine with any degree of accuracy just what the costs of farm management operations were. That the economics of farm and home management did not require the same consideration as today is evidenced by the fact that many farms and farm homes were maintained for long periods of time even though there was little indication of cash income.

Coincident with the economic conditions during this period, investigational work at the experiment stations was largely concerned with projects pertaining to quantity production, and little consideration was given to the matter of costs and quality. As a result many practices that were developed and considered scientifically sound, based on such an economic or lack of economic background, are found to be no longer satisfactory under present systems where costs of operation and consumer's demand for quality in product are factors of foremost consideration.

An up-to-date program of research in agriculture as it pertains to present-day practices on the farm and in the home must not only give the same consideration as formerly to quantity of product, but is further complicated by the demand that results must be interpreted on a basis where the economics of production and the quality characteristics of the product are properly evaluated. In the promotion of research at Massachusetts Agricultural Experiment Station it has been the hope to maintain this desirable balance, and the progress made during the last year on the several projects under investigation is reported in the following pages.

DEPARTMENT OF AGRICULTURAL ECONOMICS

Alexander E. Cance in Charge

Consumer Demand for Apples. (Lorian P. Jefferson). The study of the consumer demand for apples has been divided into three parts. The first two sections, "The McIntosh Apple on the New York Market" and "A Study of the Consumer Demand for Apples", have already been published as Bulletins 243 and 250 respectively. The third section deals with the competition between apples and other fruits, and between different varieties of apples. The data for making these comparisons have been secured from public and private records, and much of the statistical work has already been done. The study will be completed in 1930.

The Economic Worth of Different Varieties of Apples. (Lorian P. Jefferson). This project, which has been under way for several years, has still two years to run. Data are being secured for a series of seasons, numbers of trees, yields by grades, and prices, looking to a determination as to which varieties are the most profitable for Massachusetts growers. While the statistics already secured have been tabulated, no summary has yet been made nor has any attempt been made to draw conclusions.

The Nature of Consumer Demand for Poultry Products. (Lorian P. Jefferson). This study is based on data collected from consumers and retailers, and should supply information as to the type of demand in specific markets through the State and thus be of use to both producer and dealer. The gathering of this material has not yet been completed.

Part-Time Farming. (David Rozman). The field work in connection with the project on part-time farming is now completed, and the material is being prepared for publication. Three different areas were investigated.

A house to house survey was carried on in the town of Holden with a view to determining the extent and relative importance of part-time farming in a rural community. As a result it was found that of 585 operators engaged in some kind of agricultural activities in the town of Holden, 519 were part-time farmers, and only 66 bona fide farmers. Part-time farmers contributed 42.6 per cent or almost one-half of the total value of agricultural products raised in Holden.

A second part of the study was carried on in the Lowell and Taunton areas represented by towns situated in the vicinity of these industrial centers. The main object of this part of the investigation was to determine the economic and social set-up of a representative group of part-time farmers. To this end a number of part-time farmers in both areas were visited with a detailed questionnaire taking records of their occupations, date of settling on the land, extent of farming operations, living conditions, and earnings both on the farm and outside of it. A total of 115 records was obtained in the Lowell area and 84 in the Taunton area.

The data obtained in this study portray an important feature of Massachusetts agriculture and have a special bearing on the problems of land utilization, food supply, and agricultural competition in the State.

Prices of Eggs and Poultry Products. (A. H. Lindsey). Until September 1 this project was under the leadership of H. W. Yount, who completed the work on the first two parts. Data have been gathered and tabulations and correlations completed for part three. Eggs were purchased in the

Boston market in April and August to supplement November data, as quality factors do not have the same relation to price at different seasons of the year. Price factors as determined in the study have been used in forecasting the price of eggs throughout the year.

Wholesale price quotations on the Boston market form the basic material for the study. The trend of egg prices since 1904 has been upward to 1916 and sharply upward to 1920. Since 1920 the trend has been downward, declining more abruptly after 1925. Although consumer's purchasing power has been increasing since 1920, the increasing receipts have been such as to cause a decrease in the corrected prices to a point below the price in the period ending 1916.

The seasonal movement shows a definite change since 1920. The period of high prices in the fall occurs earlier, and the decline from the high period to the low point of prices is more rapid than formerly.

Prices are determined by the operation of a number of factors. The importance of the various factors changes during different periods of the year. From April to November, during the period of rising prices, demand factors have a greater influence in price determination than supply factors. In the same way, during the period of falling prices from the third week in November to early in April, the supply factors are dominant.

The Study of Competitive Factors Influencing the Supply of Market Milk and Cream in Massachusetts. (A. E. Cance). Very little has been done on this project during the year owing to lack of time. During the year 1930 it is hoped to make a study of the demand for special milk in certain cities and towns in Massachusetts and to make a survey of the changes in the local supply areas, with a view to a better understanding of the effect of prices and demand on local milk production in Massachusetts.

DEPARTMENT OF AGRICULTURAL ENGINEERING

C. I. Gunness in Charge

Investigation of Apple Storages. (C. I. Gunness). The purpose of this investigation is to determine what is a satisfactory and economical storage house for McIntosh apples. A study of weather data and soil temperatures indicates that a common storage without artificial cooling can not be depended upon to provide sufficiently low temperatures to give proper storage for an early variety of apple like the McIntosh. The use of ice in cooling an insulated storage has been found to reduce the temperature about 10° when fans are used to circulate air over the ice. It is quite evident, however, that under present labor conditions it is not practical to use ice for artificial cooling in competition with mechanical refrigeration. During the present season an investigation is being carried on in cooperation with the Department of Pomology on the maximum temperature at which apples can be stored satisfactorily. Three lots of apples were stored at 45°, 40°, and 32° from picking time until December 1. The apples were then all placed in the 32° room for the balance of the season. No results are available as yet. Another phase of the investigation deals with the efficiency of different floor materials as insulators.

Fertilizer Distributors. (C. I. Gunness). A study of two types of broadcast distributors indicates a great difference in the uniformity of application by the various machines. No results can be given at this time as additional machines are to be tested, and all are to be tested with a variety of materials.

DEPARTMENT OF AGRONOMY

A. B. Beaumont in Charge

Nitrogen Assimilation by Havana Tobacco. (A. B. Beaumont). Two nitrate salts, four ammonium salts, ammonium nitrate, and fifteen organic nitrogen compounds were used. In the selection of organic carriers preference was given those amino acids reported as constituents of cottonseed, since cottonseed meal is the principal carrier of nitrogen in Connecticut Valley tobacco fertilizers. Cottonseed meal, itself, was used. Several series of plants were grown in non-sterile and sterile water and sand cultures. Analytical data on the chemical composition of the web of the leaf were obtained for plants grown in non-sterile water cultures. (Analyses were made by P. R. Nelson of the Chemistry Department.)

Taking yield data, growth characteristics, and chemical composition as criteria of assimilation, it is concluded that, of the various nitrogen compounds studied, the nitrates are the most readily assimilated by Havana tobacco, with urea, ammonium salts, asparagine and cystine next in order of assimilation. Of the various amino acids of cottonseed meal, only one, cystine, showed any appreciable assimilability; and cystine is said to be present in cottonseed in small amounts only. Cottonseed meal itself, or its hydrolyzed products, gave no evidence of being assimilated in the unchanged form. Evidence points toward the need of ammonification and nitrification of this organic nitrogen carrier before it can be fully assimilated by Havana tobacco.

Relation of the Form of Nitrogen to Root-rot of Havana Tobacco. (A. B. Beaumont). Ammonium salts and certain amino and amide compounds have been found toxic to Havana tobacco in varying degrees. Browning and rotting of the roots and dying and dropping of the lower leaves were symptoms that accompanied this toxicity when the plants were grown in unsterilized media and containers. Tobacco grown under sterile conditions, but with the same forms of nitrogen, produced clean white roots. This is taken as evidence that the symptoms mentioned are secondary rather than primary effects of the form of nitrogen used.

Plants grown in unsterilized solutions containing nitrogen as sodium or calcium nitrate or urea produced healthy roots of a white or slightly brownish white appearance. Mixtures of nitrates and ammonium salts were toxic in proportion to the concentration of the latter. Nitrate nitrogen tended to counteract the ill effect of ammonium nitrogen on tobacco. In view of the data obtained, the toxicity of ammonium salts and certain organic compounds cannot be satisfactorily explained on the ground of either physiological acidity or hydrogen-ion concentration. Rather, it seems that improper metabolism caused by poor assimilation of nitrogen offers the best explanation of all but the extreme cases of toxicity.

Nitrogen Assimilation by Grasses and Clovers. (A. B. Beaumont). Data secured thus far indicate that nitrogen in the form of nitrate, ammonium salts, and urea is assimilated by the common tame grasses. No distinct differences in growth in the respective media have been obtained, as was the case with tobacco. Some, but inadequate, evidence has been obtained that clovers assimilate nitrogen directly from nitrates and urea but not from ammonium salts.

Ecological Study of Pasture Vegetation. (A. B. Beaumont). Further data have been obtained on the effect of lime and fertilizer nutrients on the growth of pasture vegetation. Yield records have been secured from certain plots; but on account of the excessive summer drought, differences which have appeared in other seasons did not show in the figures. In a new experiment with different forms of nitrogen applied as top dressings, the quick response of pasture grasses to nitrates, ammonium salts, and urea was very evident. Response to calcium cyanamid was slow. Subnormal rainfall may have been a significant factor in the behavior of the cyanamid. From our several experiments with nitrogen compounds it is very clear that comparatively large amounts of nitrogen do not eliminate white clover from the pasture flora.

Alfalfa Variety Tests. (A. B. Beaumont and R. E. Stitt). Further evidence has been obtained which shows that certain varieties of alfalfa originating in southern climates are not winter-hardy in Massachusetts. Tentative ranking of ten varieties grown in Test No. 1, in decreasing order of hardiness after two winters, is as follows:

1. Hungarian
2. Grimm, Ontario Variegated, Utah, Kansas, Dakota 12
3. Cossack, Argentine
4. Arizona, Ladak

No outstanding differences have appeared which could be attributed to fertilizer and lime treatments. At this stage of the test, it is very evident that varietal or strain differences are much more significant than are differences in fertilizer treatments within the range studied.

In Alfalfa Variety Test No. 2, 19 strains were seeded in 1928. The seasons' work on this test support the results from Test No. 1. A third test field of alfalfa varieties was started in August 1929. This is part of the extensive testing of legume varieties being conducted by this Station in cooperation with the Bureau of Plant Industry of the United States Department of Agriculture.

Tests of Varieties of Soy Beans and Field Peas. (A. B. Beaumont and R. E. Stitt). Twenty varieties of soy beans were grown from seed furnished by the Bureau of Plant Industry. Dunfield, Illini, Medium Green, Harbinsoy, Ito San and Habaro produced the largest yields of hay, but there were big differences in the quality based on size of stem. Large differences were also obtained in yield of seed, habit of growth, and other characteristics.

Five varieties of Canada field peas were grown. Planting time was delayed on account of the heavy rains of May. The plots were abnormally weedy and results are of little significance. Chang and Wisconsin produced the most hay, and O. A. C. 181 and Wisconsin the most seed to the acre.

The Value of Cover Crops for Onions. (J. P. Jones and M. E. Snell). The work on this project was begun in 1925. The plan has been to seed several cover crops on different plots at the last shove-hoeing and by comparison with adjacent plots without cover crops determine the effect on yield and quality of onions. Four years' records are now available. Considering the average effect on yield, red clover and rye appear to have been injurious, while crimson clover, timothy and redtop have been without effect. In 1928 and 1929 crimson clover and redtop increased the yield by 19 and 14 per cent respectively, but this was offset by decreased yields in the two previous years. A more consistent positive response is necessary before any of the cover crops thus far tested can be recommended as having a favorable influence on the yield and quality of onions.

Sulfate versus Muriate of Potash for Onions. (J. P. Jones and M. E. Snell). To answer the question frequently raised by growers as to the relative merits of sulfate and muriate as sources of potash for onions, the Station has conducted a comparative test of these two materials during the past four years. Summarizing the results for the entire period of the experiment, sulfate of potash gave an average yield of 137 bags per acre, while muriate gave 136 bags. In 1929, the year in which the onions were least affected by troubles such as blast, 242 bags per acre were obtained with sulfate of potash as contrasted with 250 bags with muriate, an insignificant difference. From the standpoint of growth of onions, it appears to make little difference which of these two forms of potash is used. In case of planning to grow tobacco on the land in the near future, it is perhaps best to fertilize with sulfate of potash to avoid any harmful effect on the burn of the tobacco frequently attributed to the chlorine carried by muriate of potash.

Lime in Relation to Onion Growth. (J. P. Jones and M. E. Snell). The experiments conducted during the past five years have shown lime to be almost indispensable in the successful growth of onions on acid soils. This has been demonstrated both on the Experiment Station farm and on several farms in the Connecticut Valley. The average of four years' results on the Experiment Station farm showed an increase of about 70 per cent in yield of No. 1 onions. Two tons of lime per acre have been about as effective as higher applications. In the last two years there has been a decline in the percentage response to lime. For instance, in 1926 and 1927 an increase of 87 and 96 per cent, respectively, was recorded for two tons of lime per acre, while in 1928 and 1929 the increase was only 51 and 33 per cent. Since the application was made five years ago, these results might indicate an exhaustion of the lime. On the other hand, this same trend is evident on the plots which received seven tons of lime per acre, and it scarcely seems possible that lime should be lacking with so large an initial application, even at the end of five years. The difference is believed to be due to a variation in seasons. In 1928 the blast hit the onions quite early, before the bottoms had begun to show appreciably. The tops were killed rapidly, and the injury seemed to be equally severe on limed and unlimed plots. The limed plots produce bulbs earlier and hence have an advantage when the blast occurs some time after bulbs have begun to form, as was the case in 1927; but in 1928, with the blast appearing just about at the beginning of bulb formation,

this advantage was greatly minimized. In 1929, however, there was no blast, and differences in earliness of bulb formation were not so important because quite favorable growing conditions prevailed throughout the season, allowing ample opportunity for the bulbs on both the limed and unlimed plots to mature. While 33 per cent increase in 1929 on the limed plot seemed small in comparison to that of previous years, the actual increase in yield per acre was approximately as large an any yet obtained.

When it was recognized that considerable lime must be added to acid soils to grow onions satisfactorily, there was some apprehension that severe damage might result through black root-rot injury should the grower wish to plant the ordinary strains of tobacco on his highly limed onion land. The Station therefore undertook some experiments looking toward the successful growth of onions at a soil reaction sufficiently acid to prevent any serious injury by black root-rot in case tobacco was grown later. Superphosphate has been credited by the Rhode Island Experiment Station and others as having an effect on acid soils, similar in some respects to that of lime. Large applications of superphosphate, alone and in combination with small amounts of lime, have been tried for the last two years. There is evidence that 500 to 1000 pounds of agricultural lime per acre in combination with 600 to 1000 pounds of superphosphate in addition to that in the regular fertilizer may be as effective as two tons of agricultural lime; but superphosphate alone, even in large applications, has not given satisfactory results. It has also been learned in this connection that onions can be grown satisfactorily at a reaction of pH 6.0. If the lime used in growing the onions has not raised the pH above this point, little injury may be expected from black root-rot should tobacco be grown on the land subsequently, especially if the soil is well drained.

Fertilizer Ratios for Onions. (J. P. Jones and M. E. Snell). This experiment was begun in 1925 with the idea of getting some estimate (1) of the relative amounts of nitrogen, phosphorus, and potash required by onions, (2) of the merits of fractional application of nitrogen, and (3) of the value of organic forms of nitrogen. All fertilizers have been applied at the rate of 2500 pounds per acre. The results at present show that increasing the phosphorus without at the same time increasing the potash is unprofitable. For instance, the 4-12-4 has given no better results than the 4-8-4, but the 4-12-8 has given an average increase of 18 per cent in yield over the 4-8-4 during the past four years. However, in 1929 the 4-12-8 did not give appreciably better results than the 4-8-4 or the 4-12-4, the large average increase being due to the large difference obtained in the three previous years.

The data on the amount of nitrogen indicate that a fertilizer carrying 4 per cent ammonia, applied at the rate of 2500 pounds per acre, will provide adequately for the first application. If necessary more nitrogen can be added later as a top-dressing, either in the form of fish or of nitrate of soda. Increasing the ammonia from 4 to 6 per cent by top-dressing has improved the yield by about 12 per cent over applying the entire 6 per cent in the first application of fertilizer. It is interesting to note that during the dry season of 1929 top-dressing with fish gave no increase in yield, while top-dressing with nitrate of soda gave a 13 per cent increase.

The 4-12-8 was used in the comparison of organic and inorganic forms of nitrogen. On one set of plots 50 per cent of the nitrogen applied came from tankage, 25 per cent from nitrate of soda and 25 per cent from ammo-phos; on the other set, about 20 per cent of the nitrogen was from calcium nitrate and the remaining 80 per cent from ammo-phos, both inorganic forms of nitrogen. With these materials differences were obtained which indicate that having some of the nitrogen in an organic form is preferable. However, the use of other sources of nitrogen might show the difference between the organic and inorganic forms of nitrogen to be less significant.

Onion Breeding. (J. P. Jones and M. E. Snell). The onion breeding work was continued in 1929 along the same line as reported last year, with major emphasis on selecting, inbreeding and mass breeding several strains of the yellow globe and Japanese set onions. In cooperation with G. B. Snyder, some effort was made to test a number of other varieties in addition to the yellow globe. This phase of the work should be pushed more vigorously during the coming year.

Influence on Onions of Rate of Seeding and Spacing Between Rows. (J. P. Jones and M. E. Snell). It was observed during the season of 1928 that the severity of the injury resulting from blast was greatly influenced by the thickness of the stand of onions. As a part of the studies made in connection with the blast problem, an experiment was laid out in 1929 to determine definitely the extent to which thickness in the row and space between the rows affected blast. There was no blast in the summer of 1929; hence nothing was learned regarding this. It was, however, possible to observe how such differences in planting affected yield and quality of onions in the absence of disease. Seeding at the rate of 3.5 pounds per acre impaired the yield out of proportion to the improvement in quality; seeding at the rate of 6.8 pounds per acre increased the yield, but not sufficiently to counteract the effects of reduction in quality. Rows 13 inches apart were found to give larger yields than those 15 or 18 inches apart, and there was little difference in quality. With seed showing a germination of 99 per cent as this did, it was concluded that for practical conditions seeding at the rate of between 4 and 5 pounds per acre, in rows 13 inches apart, will give the best returns.

In this experiment, as well as in some of the other onion experiments, counts were made of the number of plants per foot of row about the first of August. It was estimated from these data that only about 50 per cent of the seed planted actually produced plants that are likely to mature.

Relation of Aluminum Compounds to the Ill Effects of Certain Crops when Grown in Rotation. (J. P. Jones and M. E. Snell). This project includes the rotation and cover crop experiments and also that dealing with the specific effects of other crops on tobacco. In 1929 the work was redirected, looking toward a better understanding of some of the unusual results obtained with rotations. Among other things, consideration has been given to the possible relation of aluminum compounds to the depressing effect of some of the preceding crops on the yield and quality of tobacco.

Field results:—The results in 1929 were not greatly different from those

of previous years. The animal husbandry rotation consisting of corn, hay, and tobacco (the tobacco following hay) again produced a very poor crop of tobacco. The first four years timothy alone was seeded in the corn for hay, but during the last two years the plots have been divided, with timothy on the west and clover on the east halves of the plots. It was thought that the clover might improve the growth of tobacco in this rotation, but on the contrary the tobacco has been poorer after clover than after timothy two years in succession, 1928 and 1929. The tobacco was fertilized with 3500 pounds per acre of a 5-4-5 fertilizer mixture and approximately 10 tons of manure,—a more liberal treatment than was given the continuous tobacco plots which yielded satisfactorily. Corn in this rotation has generally grown well; but the timothy hay, although adequately top-dressed with fertilizer, has always been more or less of a failure. Clover, on the other hand, has grown vigorously, yielding in some instances double the amount of hay obtained from timothy.

In the cash crop rotation consisting of potatoes, onions and tobacco (tobacco following onions), the tobacco has always been superior to that produced in the animal husbandry rotation but not usually comparable to that grown in continuous culture. In 1928 the tobacco in this rotation yielded about as well as that on the continuous no-cover plots, but in 1929 the comparison was less favorable. The onions have never been especially successful, while the potatoes have been good in some years and poor in others. In 1929 a low yield of both onions and potatoes was obtained.

The comparison of timothy, redtop and rye as cover crops for tobacco was made again in 1929. The results for the past year showed timothy to be as satisfactory as either redtop or rye, and the yield of tobacco to be about as high as that on the plots without a cover crop. During the four years tested, redtop and rye have both given as good yields of tobacco as the no-cover plots. Timothy, on the contrary, has depressed the yield of tobacco three years out of six, but during the last three years it has given results just about as good as the no-cover plots.

The plots treated with manure in addition to the commercial fertilizer produced a very satisfactory crop during the season of 1929. Taking the six-year records available from these plots, very slight superiority can be claimed for the manure in comparison with a regular tobacco fertilizer. It has, however, been possible to reduce the fertilizer about 25 per cent without impairing the yield or quality of the tobacco. In response to requests from growers, the plots were divided in halves in 1929 and a sawdust stable manure was compared with the well rotted manure from the Station stables. The sawdust manure was obtained from the Quonquot stables where sawdust is used exclusively and liberally for bedding. This manure when in a pile looked more like sawdust than manure. The tobacco grew about equally well on the two types of manure. No injurious effect was noted from the sawdust. One year's results are not sufficient, however, to make any claims about the use of this manure year after year.

Tobacco after corn grew quite vigorously in the season of 1929 but yielded only 1692 pounds per acre in comparison with 1785 pounds after hay and 1890 pounds after tobacco. After onions and potatoes the yields

were about the same but somewhat lower than after corn and hay. This is an unusual result because in previous years better yields have been obtained after onions and potatoes than after corn and hay.

In 1929 brown root-rot affected the roots of the tobacco but slightly on the cover and no-cover crop plots but did injure the roots of the tobacco in rotation with corn and hay very severely and to a less extent that in rotation with potatoes and onions.

In the greenhouse, with water cultures, aluminum has been found to produce an effect on tobacco roots similar to that of brown root-rot in the field. Thinking that aluminum in the soil might be a factor in causing brown root-rot in the field, treatments were made on the rotation plots to eliminate any effect of soluble aluminum. These treatments consisted of large applications of superphosphate, which experiments at other stations have proven to be successful in counteracting the injurious effects of aluminum. The results were not particularly encouraging. Brown root-rot was just as severe where the superphosphate treatments were made as where they were not. The yield was not increased by the superphosphate, which is contrary to experience with similar treatments on other plots in the absence of brown root-rot. It might be said from this year's experience, if it can be assumed that superphosphate renders soluble aluminum inactive, that the brown root-rot found in the field is not caused by an excess of soluble aluminum, and that it is a different type from that observed in the greenhouse water cultures as resulting from aluminum injury.

Soil nitrate determinations were made during the growing season of 1929 to see whether plowing under carbonaceous residues had reduced the available nitrogen, as found by other experiment stations. The data obtained are in agreement with those of previous years in showing no case where the residues turned under in the rotations have reduced the available nitrogen to the point where it limited the growth of tobacco.

Quantity of Nitrogen and Phosphorus for Tobacco. (J. P. Jones and M. E. Snell). The phase of this experiment dealing with the amount of nitrogen required in growing tobacco was started in 1926. The recommendations which seem justified from work on the experimental plots to date are: (1) In the absence of barnyard manure, 150 pounds of ammonia per acre is the minimum that should be considered in fertilizing tobacco; (2) a somewhat better yield has been obtained each year with 200 pounds of ammonia per acre than with 150 pounds, and for many fields the larger application may be nearer the optimum; (3) although in previous years 250 pounds of ammonia per acre produced slightly superior yields, in 1929 it gave no better yields than the 200-pound treatment; and it has been concluded that this large application will prove profitable only in unusual situations.

Among the observations made on tobacco, it was noted that the reduction in growth due to the deficient nitrogen was always apparent before the typical yellow color signifying nitrogen starvation. In 1928, a rainy season, the yellow color was found much earlier than in 1929, a dry season. Although reduced growth could be seen readily on the low nitrogen plots in 1929, yellowing of the leaves was scarcely perceptible even at the time of harvest.

In the experiments with quantity of phosphorus, attempt has been made to measure the stimulative effect on the growth of tobacco of large applications of superphosphate, rather than to determine the optimum nutrient requirement of tobacco for phosphorus. During the first season, 1928, when one-half, one, two, and four tons of superphosphate per acre were applied in addition to that in the regular tobacco fertilizer, notable increases in yield were obtained, the maximum being from the two-ton treatment. In 1929 much larger yields were obtained, but there was no response to the excessive applications of superphosphate. In another experiment, however, the yields were markedly stimulated by four tons of superphosphate. A very interesting feature of these experiments has been the observation on maturity. Contrary to what is generally expected from excessive applications of phosphorus, there has been no evidence that the tobacco has matured unusually early or any differently from that not receiving the extra phosphorus.

The Magnesium Requirement of Certain Common Crop Plants. (J. P. Jones and M. E. Snell). This experiment was started in the season of 1929 and is a redirection of previous work which had shown a magnesium deficiency in the soil of one of the old experimental fields at the Station, illustrated by certain symptoms on both corn and tobacco. The work as now outlined consists of an attempt to observe the symptoms of a lack of magnesium on several of the commonly grown crops, such as onions, clover, timothy, alfalfa, and potatoes. The season was too dry in 1929 to permit a satisfactory growth of these crops; hence the observations made are not considered sufficiently satisfactory to draw conclusions at this time. It has also been proposed in connection with this work to make some chemical studies of this and other soils, hoping to account more definitely for the lack of magnesium. Progress is being made on this phase of the work, but no results can be included in this report.

DEPARTMENT OF BACTERIOLOGY AND PHYSIOLOGY

G. E. Gage in Charge

Nitrogen-Fixation in Relation to Legumes and Non-Legumes under Defined Agronomic Conditions. (James E. Fuller). This project has been followed out as outlined for the last year: namely, to study soils of different units to determine the ability of these units to fix atmospheric nitrogen; to isolate organisms from the units and study the distribution of nitrogen-fixation organisms as compared with the nitrogen-fixation power of the soil units; and lastly, to study factors which may influence the presence and activity of nitrogen-fixing organisms isolated in the studies. The preliminary phase of this project has been completed and has been written up and accepted for publication by *Soil Science*. It will appear in the next May or June issue of that journal. The first part of this study was carried on by Dr. Leon A. Bradley and was taken over in 1928 by Dr. James E. Fuller. A summary of this preliminary investigation as carried out on an experimental field (Field A) divided into twenty-four plots, has furnished the following information.

Four definitely planned experimental conditions were established for the defined agronomic work:

1. Units planted with legumes and receiving fertilizer.
2. Units planted with legumes and not receiving fertilizer.
3. Units receiving fertilizer but not planted with legumes.
4. Units not receiving fertilizer and not planted with legumes.

From this summary there appears to be sufficient nitrogen-fixation in the soil of Field A to account for the nitrogen reserve. The nitrogen-fixation in the experimental field is correlated with the presence of a strain of Azotobacter capable of fixing substantial quantities of nitrogen when cultivated in pure culture in a nitrogen-free medium. Nitrogen-fixation and the distribution of the Azotobacter appear to have remained reasonably constant over a three-year period. The growth of the legume and non-legume crops has not influenced nitrogen-fixation or the distribution of the Azotobacter. The hydrogen-ion concentration of the soil of the experimental field does not appear to be the controlling factor in the nitrogen-fixation or the distribution of the Azotobacter. The data as accumulated in this study have furnished considerable information which may later be placed on a basis for the establishment of practical methods by which the nitrogen-fixation organisms *naturally present in soil* may be stimulated to greater activity.

Laboratory Service. (Ralph L. France). More than one thousand examinations of samples were made by the department during the past year. Of this number, seven hundred were control tests of various town milk supplies in the Connecticut Valley. In many cases monthly control tests are made, and in other cases the testing is done at different times during the month. At the present time the activities in this phase of the laboratory work are somewhat limited because samples can be transported only short distances. Then, too, the Massachusetts State Department of Health carries on activities especially for those dairies and town health departments located in the Boston or metropolitan district. Many samples from private water supplies have been submitted to the laboratory for examination. These have been for complete bacteriological and chemical examination, for the most part, to determine the purity of the water in question. It is of some interest to us from the standpoint of public health to note that nearly 50 per cent of the private supplies were found to be unsafe. This indicates the need of more active education in the construction and location of private water supplies. It also indicates the need of a sanitary survey of water supplies as regards those located on private property.

The sale of legume cultures has materially decreased during the year. This is no doubt due to the activities of certain commercial concerns which are supplying cultures free to purchasers of legume seeds in bushel lots.

Other services rendered by the laboratory are:

1. Bacteriological analyses of food and food products, milk and milk products, and water.
2. Chemical analyses of milk and water.
3. Preparation and distribution of viable and efficient cultures of nitrogen-fixing bacteria for leguminous crops.
4. Testing of nitrogen-fixing bacteria for quality.

5. Bacteriological examinations concerning sewage disposal.
6. Bacteriological examinations of swimming tank waters for purity.

Studies on the Indol Tolerance of the Colon-Aerogenes Group of Bacteria as a Possible Means of Differentiating Fecal and Non-Fecal Strains Occurring in Drinking Water Supplies. (Ralph L. France). The results to date are very promising and it is hoped that the study will supply a more accurate method of testing water for fecal contamination.

The laboratory is now in its second year of service and the indications are that it is well established and conducted for the kind of work assigned to it. This type of supplementary investigational program will aid materially in the value of the service.

DEPARTMENT OF BOTANY

A. Vincent Osmun in Charge

Tobacco Diseases. (W. L. Doran).

Black Root-Rot. A paper on the effects of soil temperature and reaction on growth of tobacco infected and uninfected with black root-rot has been accepted for publication in the *Journal of Agricultural Research* for December 1, 1929.

In the field experiments, the pH values of soil in limed plots have remained practically unchanged at about 6.0 for the past four years. Neither alfalfa nor timothy, grown two seasons on limed plots, has resulted in soil significantly more acid than has continuous tobacco. Of the acidifying treatments of limed soil, the most effective were sulfuric and orthophosphoric acids applied together in two successive years, and sulfur (400 lbs. per acre) applied in two successive years. The application of any of these treatments in only one year (1926) had but slight effect, if any, on soil reaction after 1927. Examination of roots indicated that black root-rot in these plots was suppressed in proportion to the effectiveness of the acidifying applications.

Yields on unlimed plots without acidification and with tobacco grown continuously were 28 per cent greater than on limed plots (last limed in 1923). Yields on limed plots were increased by all the acidification treatments as compared with yields on limed plots without acidification. Sulfur (200 lbs. per acre) applied in 1926 and 1927, and sulfuric and orthophosphoric acids applied together in the same years gave the greatest increases.

Investigation of the use of various chemicals for the prevention of black root-rot and other soil-borne diseases of tobacco seedlings has continued. Acetic acid treatment of the soil was tested in several commercial seed beds. In every case the treatment resulted in suppression of weeds and successful control of both damping-off and black root-rot. It compared favorably with steam sterilization against which it was checked.

Tests with monochloracetic acid were not encouraging. Interesting and promising results were obtained with pyroligneous acid. Experiments were conducted with the object of adding to our knowledge of the effect of

soil conditions on the efficiency of acetic acid and formaldehyde as soil disinfectants.

Study was made to determine whether the inhibiting effect of acid soils on *Thielavia basicola* may be directly due to some other factor than hydrogen-ion concentration, more especially active aluminum. Results indicate that aluminum sulfate is about as effective as sulfur and sulfuric acid in acidifying soil and in suppressing the black root-rot fungus.

Earlier experiments indicated that phosphoric acid is markedly favorable to the parasitism of *Thielavia basicola* and that its influence may be as great as that of soil reaction, or greater. The effect of this chemical on black root-rot, growth of tobacco, and soil reaction is now being studied in a new series of pot experiments.

Brown Root-Rot. Field studies have continued on the plots originally planned for investigation of black root-rot. In general, there was practically no brown root-rot on plots in continuous tobacco since 1921; some brown root-rot occurred wherever tobacco followed either timothy or alfalfa, but was somewhat more severe in limed plots following timothy. The presence of brown root-rot was generally accompanied by reduction of yield, but a consistant relation between disease and yield was not always found.

On the theory that timothy sod is injurious to tobacco because of the large amount of cellulose and the low amount of available nitrogen present, Johnson and coworkers of the Wisconsin Station recommend applications of nitrogen where tobacco follows timothy. In order to determine the effect of nitrate (calcium nitrate), and the time of its application to timothy sod, on tobacco and on brown root-rot, a series of pot experiments was conducted. From these it may be concluded that heavy applications of calcium nitrate to timothy sod reduce the severity of brown root-rot; and that the nitrate increases growth much more when applied to brown root-rot soil than when applied to soil which does not contain the cause of brown root-rot.

Assuming a hypothetical relation between brown root-rot and activities of soil organisms resulting in a lack of nitrogen or in the formation of substances (undetermined) toxic to tobacco, it would seem possible that certain inorganic salts applied to the soil might affect the disease through their toxicity to the organisms or by chemically inactivating certain toxic substances. Experiments based on this theory are under way, but it is too early to report definite results.

Control of Diseases of Greenhouse Vegetables. (E. F. Guba, Waltham).

Leaf-Mold of Tomatoes. Work on this disease during the last year has been concerned mainly with house management as a means of control. The conidia of the causal fungus germinate at a relative humidity of 100 per cent, which in the greenhouse is attained on the leaf surfaces when the atmospheric humidity is above 85 per cent. Proper adjustment of air circulation, water and heat is necessary to maintain conditions unfavorable to conidial germination, and this ordinarily involves much labor and attention by the operator. In this investigation equipment for the automatic control of temperature and humidity has been employed. In the light of knowledge previously gained in laboratory study of the causal fungus and observations in the greenhouse, a set of house management

practices was evolved to provide proper conditions for the control of leaf-mold. Experiments were conducted for comparison of "good" and "bad" growing conditions as related to control of the disease. Proper management resulted in decreasing leaf infection about 70 per cent and yield of fruit was increased 18 per cent.

Downy Mildews of Cucumber and Lettuce. (W. L. Doran). The first appearance of downy mildew on cucumbers in the field was recorded on August 19, only a few days later than for the last five years,—and this despite the extremely dry summer, in which neither onion nor potato mildew was observed in this region. The disease was no less severe in some fields where cucumbers had not been grown for at least three years previously than on fields where cucumbers were affected with the disease last year.

Lettuce mildew rarely occurs in the field here except in cool weather in fall. Attempts to maintain the fungus on infected plants (Belmont variety) set in the field in May failed, probably because of the warm, dry weather. Observations indicate that high air temperature constitutes an important natural defense against this disease in the field.

In the greenhouse, work continued on the relation of management and the use of fungicides to the control of these diseases. Experiments to determine whether potash and lime applied to the soil tend to decrease susceptibility of cucumber plants to attack by downy mildew produced only negative results.

Pseudoperonospora of cucumber and Bremia of lettuce were successfully grown for several weeks on detached cotyledons of host seedlings floated in a 5 per cent solution of sucrose in Petri dishes. It is thus possible, by occasional transfers, to maintain these fungi when conditions in the greenhouse do not favor their growth.

Study of over-wintering of downy mildew of cucumber added nothing to previous knowledge of this phase.

Eradication of Nematodes in Greenhouse Soils. (L. H. Jones). Work previously reported has shown that a combination of acetic acid with calcium cyanide will eradicate nematodes. Of considerable importance is the fact that two treatments with this combination must be used, with an interval of about seven days between the treatments. The rôle of the acetic acid in the combination chemical is apparently that of a carrier for the lethal cyanide. The effect is to maintain the fairly volatile cyanide gas in the soil much longer than it would ordinarily persist if the acetic acid were not used. If this same principle could be applied by using a dry chemical in place of the liquid acetic acid the idea would have a better opportunity for adoption in agricultural practice. Paradichlorobenzene, the P. D. B. used in eradicating peach borers, seems to fulfill the same rôle as acetic acid. It is a dry chemical and when mixed with calcium cyanide the combination remains a true mixture. There is no caking and once a uniform mixture is attained it remains as such. One treatment with this combination reduces the numbers of nematodes considerably, but eradication is not obtained unless two treatments are used with an interval of one week between applications. The use of the paradichlorobenzene with calcium cyanide has been tried by varying the proportions of each chemical and also the amount applied. In general the results indicate that

a 1:1 ratio is the best, and three grams of the mixed chemicals for a six-inch pot of soil proved the most efficient rate of application. Before this method can be demonstrated on a commercial scale, there are certain problems that must be solved by the laboratory method.

Eggplant Wilt. (E. F. Guba, Waltham). Addition of chemicals to the hills at planting time, with the object of sterilizing the soil about the roots, gave no control of the wilt disease. Negative results were also obtained with the use of a paper mulch. Studies in several fields of the New York Purple variety indicate that the eggplant tolerates a high degree of soil acidity, and that this condition usually is accompanied by an insignificant amount of wilt. These findings point to the changing of soil reaction as a means of controlling wilt, and efforts are being directed toward this objective.

Onion Blast. Several departments cooperated in work on various phases of the problem presented by the disease of onions known as *blast.* A field survey and spraying and dusting experiments were conducted by A. I. Bourne (Department of Entomology) and W. L. Doran (Department of Botany). Weather conditions were unfavorable to the development of blast, and the trouble did not occur. Drought injury and thrips injury were severe in many fields. Because of the absence of blast and downy mildew, no data were obtained on the effect of dusts and sprays on these diseases. The joint effects of chemicals and mechanical injuries were such that it was concluded safe to spray six times with 4-4-50 Bordeaux, but not nine times; three times with 8-4-50 Bordeaux, but not five times; and six times with milk of lime, but not nine times. Copper-lime dusts proved more injurious than any of the Bordeaux mixtures.

L. H. Jones (Department of Botany) worked on the physiology of onion blast. Growing onions under conditions of reduced light and high humidity tended to reduce root growth and to produce tender tops. Subsequently, when exposed to hot sunshine and drying wind, these plants were injured in a manner resembling the condition known as blast.

Carnation Blight. (E. F. Guba, Waltham). The toxicity of fungicides to spores of the causal fungus (*Alternaria dianthi* S. & H.), the prevention of infection of potted plants which were artificially inoculated with spores of the pathogene, and the control of the disease in the field have been studied. In the toxicity tests with spores, naphthalene dust proved the most effective of twelve fungicides employed. In an experiment on the prevention of infection, five fungicides were used, each applied alone and in combination with fish oil. Calcium arsenate with fish oil and Bordeaux mixture with fish oil gave the best results. Results of a second experiment substantiated those of the first and indicated no advantage in the use of saponin as a spreader. Thirteen distinct treatments were compared in a spraying experiment in the field. Bordeaux combined with calcium arsenate and fish oil was the most effective of the fungicides used. Copper-lime dust and calcium arsenate proved the least effective. Calcium arsenate, alone or in combination with lime-sulfur, caused injury to the plants.

Forcing Gladiolus with the Aid of Artificial Light. (L. H. Jones). The embryonic flowers of the gladiolus are formed a few weeks after the corms are planted. Under normal out-of-door cultural conditions this

period would be during the longest daylight exposures of the year. A preliminary pot experiment indicated that a marked increase in bloom could be obtained by supplementing the daylight of late fall and early winter employing 100-watt electric light bulbs.

An experiment based on this light factor in which four plots were used was set up in January, 1929. Black curtains separated the plots receiving artificial light from those receiving no artificial light at night. In each plot 195 corms were planted and a careful record was made of the number of flowering spikes and the number of flowers on each spike. The results showed that light had caused an increase of 63 per cent in the number of spikes and an average increase of 30 per cent in the number of flowers on a spike.

The time of year has considerable influence on the time interval from planting to flowering, and this time interval is increased by the use of artificial light. In these experiments artificial light retarded the date of flowering by approximately fifteen days.

The variety Crimson Glow was used in conducting this investigation.

Influence of Light Quality on Plant Growth. (A. V. Osmun). Preliminary experiments have been conducted to test the effect of so-called health glass (glass which transmits a considerable percentage of the ultra-violet rays) on plant growth and development. Plantings were made in a lean-to greenhouse in which one-half of the ordinary glass had been replaced by Vita glass. Radishes grown under Vita glass showed a gain of 71 per cent in weight of the entire plant and 124 per cent in weight of roots as compared with an equal number of plants grown under ordinary glass. Similarly, lettuce gained 76 per cent in weight and formed much more compact heads when grown under Vita glass. No consistent results were obtained with calendulas and pansies.

The Effect of Pot Structure on Soil Temperature. (L. H. Jones). A series of tests conducted with various types of plant containers has shown that the structure of the container has a marked influence on the temperature of the soil. The regulation three-inch standard clay pot will maintain a soil temperature as much as 20° F. below that of the air in a greenhouse on a hot day. On the other hand, a pot of vitreous material or a glass tumbler will maintain a soil temperature that lags only 1° or 2° behind the rise and fall of the air temperature.

Between these two extreme types of pots, the former very porous and the latter with no porosity, there are intermediate types of pots that maintain their soil temperatures according to the amount of moist area presented by the pot to the air in the case of the porous pots, or else the soil temperature will be influenced by the insulating value of the pot material in the case of the non-porous pots.

The cooling effect by evaporation of moisture from the outside of the pot persists as long as the pot is able to withdraw moisture from the soil to moisten its surface.

THE CRANBERRY STATION

(East Wareham, Massachusetts)

H. J. Franklin in Charge

Injurious and Beneficial Insects Affecting the Cranberry. (H. J. Franklin).

(a) Penetrol, an activating oil developed under the auspices of the Crop Protection Institute, was tried with nicotine sulfate and also with pyrethrum soap in tests to control the black-headed fireworm, with negative results.

(b) Dipple's oil was tested as a repellent against the cranberry fruitworm moth, with negative results.

(c) The relationship of birds to cranberry pests was studied somewhat. Birds were killed and the contents of their digestive tracts examined.

(d) Entomogenous fungi parasitic on the black-headed fireworm were cultured and disseminated on cranberry bogs to test the possibilities of practical control of the fireworm by the use of these fungi. Dr. William H. Sawyer, Jr., was in charge of this work. Practicable methods for growing the fungi in quantity were developed, but the results of field dissemination were not successful enough to make this method of control seem very practicable.

(e) Japanese beetle traps and baits were tried against the cranberry root grub beetle, with mostly negative results.

(f) The life histories of the cranberry black bug (*Plagiognathus repetitus* Knight) and the false blossom leafhopper (*Euscelis striatulus*) were studied.

(g) Various kinds of fish were tested as possible water indicators to be used when flooding cranberry bogs to determine readily when such flooding has become dangerous. This study gave very promising results. Dr. H. F. Bergman was in charge of this work.

(h) Profitable studies were conducted on the distribution and habits of the cranberry white grub (*Phyllophaga anxia* Lec.).

(i) Spray tests against the false blossom leafhopper, with nicotine sulfate and with pyrethrum soap, brought out very clearly the fact that the latter controls the pest much more effectively than the former, while the two insecticides used together caused considerable injury to the vines.

Cranberry Disease Work. (H. J. Franklin in cooperation with the Bureau of Plant Industry, U. S. D. A.). Dr. Neil E. Stevens of the Bureau of Plant Industry was at the Cranberry Station during much of the growing season and cooperated actively as usual in this work.

(a) Final and conclusive proof was developed that the false blossom disease is carried freely from diseased to healthy vines by the leafhopper (*Euscelis striatulus* Fall.) This is very important and should lead shortly to a much better control of this serious disease than has been achieved in the past. Other experiments gave little evidence, if any, that the cranberry black bug, cranberry spittle insect, sharp-nosed leafhopper (*Platymetopius magdalensis* Prov.), or springtails (Collembola) have anything to do with the spread of the disease. The history of the spread of this disease in Massachusetts was given further careful study to make it as complete as possible.

(b) Dr. Stevens continued and extended his studies of the relationship of weather to the keeping quality of the fruit, and his incubator tests of keeping quality.

(c) Dr. Stevens made studies of the relative thickness of the cuticle of the berries of many different varieties to see if this showed any correlation to varietal disease resistance. The study gave negative results which were, nevertheless, highly significant and of great importance.

Weather Observations with Reference to Frost Prediction. (H. J. Franklin in cooperation with the U. S. Weather Bureau).

(a) Reports of local weather observations made at 8 a.m. (Eastern Standard Time) were made daily by telegraph to the office of the Weather Bureau at Boston. General weather observations were made and recorded at 8 a.m., noon, and 8 p.m. and were reported on a card form to Boston daily.

(b) Further weather records likely to have a bearing on frost forecasting were accumulated from observing stations in North Harwich, East Wareham, Carlisle, Holliston and Worcester, as well as the regular cranberry observing stations at Marstons Mills, South Carver, Norton, Halifax, South Hanson, and Pembroke.

(c) Studies of observations already recorded yielded important new knowledge on this subject, making possible further definite improvement of the formulae for computing temperature minima. In the formulae thus modified, the dew-point and the reading of the wet bulb thermometer are the significant data mathematically combined.

(d) Forecasts of minimum bog temperatures were made in the frost seasons at noon and at 7 p.m. (Eastern Standard Time). These forecasts were distributed by the New England Telephone & Telegraph Company as heretofore, the cost of distribution being paid by the Cape Cod Cranberry Growers' Association.

Varieties. Dr. Sawyer made hydrogen-ion determinations of the foliage of many of the cranberry varieties at different times of the day and night and of the growing season. It was thought that this work might show a correlation between pH values and productiveness or disease resistance in cranberry varieties; but while the pH of the different varieties showed interesting variations, no very certain correlation of this kind was disclosed.

DEPARTMENT OF DAIRY INDUSTRY

J. H. Frandsen in Charge

A Study of Packaged Ice Cream. (K. E. Wright). This project has continued uninterruptedly during the year. Much work has been done as a check on preliminary conclusions reported in the last Biennial Report. Research work has also been done on several other phases of this problem. Considerable study has been made in an effort to determine just why a maximum drawing temperature of 25.5°F. seems necessary in the case of a 12 per cent fat, 10 per cent serum solids, 15 per cent sugar, and .45 per cent gelatin mix. A study of the rate of cooling samples drawn from the freezer at various temperatures indicated no difference as far as evolution of heat fusion and crystal formation are concerned.

From a study of the effect of aging on the texture of ice cream, the following conclusions have been drawn:

1. A high initial temperature in the aging period of the ice cream mix favored the development of greater basic viscosity.
2. The maximum viscosity was found to be imparted when the mix was held at a temperature of 80 to 100°F. for two to four hours, without agitation.
3. The whipping property was decreased as the viscosity increased.
4. The rate of melting was decreased as the viscosity increased. The manner of melt-down was also influenced by difference in viscosity.
5. The texture was improved as a result of greater viscosity development.
6. The influence of aging in ice cream has been attributed largely to the factors affecting crystallization of the gelatin portion of the product on the basis of the data obtained.

The Quinhydrone Electrode in the Dairy Laboratory. (Work started by A. W. Phillips and now conducted by K. E. Wright.)

Further study indicates that since different kinds of milk bacterial flora function in different ranges of pH, and since milk has a relatively high buffer value and perceptible changes in pH do not take place with appreciable additions of acid or alkali, the quinhydrone electrode determination of pH cannot be used for determining accurately the keeping quality of milk. This work agrees with conclusions reached by A. W. Phillips.

The Utilization of Frozen Fruits in Ice Cream. (M. J. Mack). This project, now in its second year, is being conducted in cooperation with the Department of Horticultural Manufactures. Fruits made available in a study of cold packing methods are being used in the manufacture of fruit ice cream.

The varieties of fruits which were found to be most satisfactory for freezing are likewise superior for use in ice cream. The optimum percentage of fruit in fruit ice cream was found to be approximately 15 per cent for cold packed strawberries; 8 to 10 per cent for raspberries, plus a suitable amount of raspberry extract; 15 to 20 per cent for peaches in combination with an extract; and 12 per cent for cherries. The desirable ratio of fruit to sugar in the pack used for ice cream making was found to be 2:1 and 3:1 for cherries and strawberries, and 3:1 for raspberries and peaches. Fruit frozen without sugar or with corn sugar as a substitute for cane sugar was unsuitable for use in ice cream.

The fruit should be added to the ice cream directly after the freezing operation is started in order to insure the maximum of fruit flavor and even fruit distribution as well as more rapid freezing and whipping of the ice cream. Fruit ice creams have a lower freezing point than plain ice cream and should be drawn from the freezer at a temperature at least 1 to 1.5°F. lower than is necessary for plain ice cream. Fruit ice creams cool faster in the freezer, whip faster, and require a shorter time of brine flow than does plain ice cream made from the same basic mix.

A Study of Frozen Sweet Cream for Use in Ice Cream. (M. J. Mack). Sweet cream of good quality can be stored satisfactorily in the frozen

state during surplus periods for later use in ice cream. Cream of low acidity will remain in good condition for several months if sufficiently low temperatures are employed; i.e., 0°F. or lower. Ice cream of desirable flavor can be made from frozen sweet cream provided not more than one-third of the fat content of the product is derived from this ingredient.

Ice cream mixes containing frozen sweet cream are high in viscosity, due in part to excessive clustering of the fat globules after homogenization. Frozen sweet cream has been found to be an overrun deterrent, such mixes requiring about 10 to 20 per cent more time to whip. An attempt is being made to find a method for storing sweet cream so that it can be used without increasing the mix viscosity and length of freezing. Data secured to date indicate that combining some of the gelatin or sugar with the cream previous to freezing will produce a resultant mix of lower viscosity and a more normal freezing time.

A Study of Electric Refrigerated Milk Cooling Tanks. (J. H. Frandsen and H. G. Lindquist.) Work on this project was started in the summer of 1929, the object being to determine the efficiency and cost of cooling milk in electric refrigerated cooling tanks. Several different makes of electric refrigerated units have been installed and data collected as to the length of time required to cool milk from 90 to 50°F., and the amount of current necessary to cool milk under ordinary farm conditions. The data thus far collected are not sufficient to warrant definite conclusions.

A Study of the Changes that Occur in the Storage of Frozen Sweet Cream. (H. G. Lindquist). Preliminary experiments have been made, but not enough work has been done to justify conclusions.

DEPARTMENT OF ENTOMOLOGY

H. T. Fernald in Charge

Dates of Hatching of Scale Insects and When to Spray for Them. (A. I. Bourne). The necessary observations on critical stages in seasonal development of these insects and their correlation with climatic conditions for the past season have been recorded.

The scarcity of previous work along these lines gives almost no background of accumulated facts to assist in interpretation of results. This has necessitated observations over a long period, to determine accurately the influence of abnormal seasons.

It has been found that the variations in temperature in late fall and the severity of the following winter exert a great influence upon the rate of development of these insects.

The marked contrast in weather conditions in the years 1928 and 1929 has afforded unusual opportunity to determine the effect of such extremes, particularly upon the spring appearance of young scales in the single-brooded species, Oyster-shell Scale, and upon similar development in the summer generation of a two-brooded species, the Pine Leaf Scale.

Investigation of Materials Which Promise Value in Insect Control. (H. T. Fernald and A. I. Bourne). The chief attention this season has

been directed toward the comparative efficiency of different types of oil sprays for European red mite control, as well as checking them from the standpoint of safety to the trees.

Against a moderate infestation of red mite, almost all of the oils tested gave satisfactory control, indicating that in general, under such conditions, thoroughness of application and proper timing are more essential than the mere choice of oil spray.

In some cases, after conference with manufacturers, oils were applied at an advanced strength over that previously recommended, in order to meet Massachusetts conditions better.

The effect of combining certain types of oil sprays with sulfur or copper fungicides was studied, both from the standpoint of safety to the trees and of effectiveness against red mite. The results of these tests indicated that these oils can be so used, safely and without impairing their insecticidal value.

The abnormally high temperature in early April afforded opportunity to study the effects of oil sprays for delayed dormant application under conditions very unusual in Massachusetts. The burning which resulted pointed out the posibility of maximum temperature requirements for safe application of oil sprays in addition to the minimum limits with which Massachusetts growers are familiar.

A study of a recently developed sulfonated, oxidized oil spray was begun, particularly as to its possibilities as an activator for nicotine. Preliminary tests have shown that a dilution of one-half to one per cent, when combined with nicotine sulfate, gives satisfactory control of some insects, with concentrations of nicotine much lower than those at present recommended. This means a material reduction in the cost of such sprays which are at present relatively expensive.

Control of Onion Thrips. (A. I. Bourne). The summer of 1929 was characterized by conditions of severe drought. Such an abnormally dry season was very favorable for thrips development. Throughout the early summer the infestation was comparatively light and of little consequence. During July and August, when the effects of the continued drought became more pronounced, thrips increased rapidly and many onion fields suffered severely from the combined effects of thrips and dry weather. In the absence of blast and mildew, however, the plants on the whole remained green and vigorous considerably later than in the years when those diseases were prevalent. The period of abundance and activity of thrips was proportionally lengthened.

Some growers became interested in the possibilities of biological control of thrips, purchased a quantity of lady beetles from a western state, and liberated them in a field where thrips were abundant. The effort was not crowned with any conspicuous success. Examination of onion fields in the Valley, throughout the season, resulted in the collection of at least five different species of predacious beetles, all of them well established in this region. The beetles imported from the West belong to one of these species.

Field tests demonstrated the nicotine-soap combination to be an effective killing agent against thrips, and the machinery for application practicable. In cooperation with the Department of Botany studies were made

of the relative efficiency of combined sprays of nicotine and copper fungicides, for the control of thrips and blast or mildew, or both.

Preliminary tests were made of a new spray material designed to serve as an activator of nicotine, with the view of lowering the strength of the nicotine sulfate spray from present requirements without impairing its efficiency against thrips.

In cooperation with the Department of Botany, observations of onion fields in the Valley were made throughout the season to note the appearance and extent of blast and the correlation, if any, of this disorder with insect activities.

Control of the Plum Curculio in Apples. (W. D. Whitcomb, Waltham). High temperatures in May and June stimulated the beetles to make two to three times as many punctures per day as were observed in previous years. Parasitism was exceedingly low. Early in the season the number of punctures made in sprayed and unsprayed fruit was approximately equal, but two weeks later the beetles made 103 punctures in the unsprayed fruit and 12 in the sprayed fruit. Laboratory poison experiments again indicated that lead arsenate at the rate of 2 pounds in 50 gallons of water is the minimum dosage which should be used, and that calcium arsenate is superior to lead arsenate in equal units by weight. Fish oil sticker again increased the effectiveness of the poison but less than in previous years.

In confinement, beetles were attracted to and fed freely on dried fruit baits containing various poisons. However, preliminary trials with these baits in the orchard failed to show beneficial results, indicating that the method of exposing the baits needs further study.

Spray Residue Problem and Its Relation to Orchard Practices. (A. I. Bourne). Spraying and dusting experiments on the three standard varieties of apples, Wealthy, McIntosh, and Baldwin, were continued in 1929.

The experience of the past summer has demonstrated the very great influence which the type of season has upon the problem of spray residue on fruit at harvest. Compared with the two previous years, the rainfall in 1929 during the period between the calyx spray and harvest was relatively insignificant, as noted below.

	Rainfall—inches		
	1927	*1928*	*1929*
Wealthy	13.0	23.5	7.8
McIntosh	14.6	24.6	8.4
Baldwin	18.5	25.0	10.3

Under such conditions, much of the spray deposit normally removed from the fruit by rainfall persisted throughout the season. Consequently, sprays could not be applied after early summer with any assurance of safety, especially on Wealthy or McIntosh. On the other hand, even the late summer applications of sulfur—lead dusts on these same varieties were made without encountering any difficulties as to residue.

Biology and Control of the Carrot Rust Fly. (W. D. Whitcomb, Waltham). The general infestation by the first generation of the carrot rust fly was much less than in 1928 due to unfavorable conditions for oviposition; consequently injury by the second generation was also somewhat lighter.

Flies emerged from 92 per cent of the pupae confined in *slightly* moist sand and loam, and from 80 per cent of those in moist sand and loam, but from only 50 per cent and 33 per cent of those in wet loam and dry sand, respectively. Due to climatic conditions the flies emerged from 10 to 14 days earlier than in 1928. This condition continued through the summer and resulted in the emergence of thirteen third generation adults, the first observed at Waltham.

Preliminary studies were made with potted carrots grown from seed treated with mercury compounds. Where calomel was dusted on the soil as well as the seed, the plants showed 35 per cent less injury than plants from untreated seed. Plants from Semesan treated seed showed very little infestation.

Studies were made of the effect of different sprays on the adult flies. The relation of planting dates to percentage of injury by first generation larvae was also studied as well as relative susceptibility of different varieties.

Mulch paper effectively checked the first generation infestation, but the second generation damage was from 5 to 17 per cent greater under the paper.

Studies were made with insecticides and repellents. Some of the materials showed considerable promise, although the protection from second generation attack was somewhat less pronounced.

Systematic Study of Oil Sprays. (H. T. Fernald). The entomological part of the project during 1928-29 has been restricted mainly to conferences with the Department of Chemistry which is cooperating in the project, in order to keep in touch with the work done and to obtain a thorough understanding of the chemical processes made use of. It now seems probable that some of the materials desired for field tests may be available for this purpose the coming spring, and these tests will be made by the Department of Entomology.

FARM DEPARTMENT

Enos J. Montague in Charge

Intensive Grassland Management under the Hohenheim System. (E. J. Montague, C. H. Parsons and R. C. Foley). In the spring of 1928 an experiment in intensive grassland management, under the Hohenheim System, was put into operation. This originated in Germany during the World War and has since been used successfully in the Netherlands and the British Isles. It is designed to provide a luxuriant growth of grass rich in protein, thereby making it possible for the dairy farmer to produce on his own farm most of the feed necessary for his herd, at least during the summer months. On the College farm this system has greatly reduced the amount of concentrates fed in the summer and has yielded an average return per acre of $69 a year from the plots to which complete fertilizer was applied, as compared with an average return of $22 from the unfertilized plot.

The Hohenheim System is based upon four distinct principles: division

of the area into plots, combination of grazing and hay land, use of concentrated fertilizers, and rotational grazing.

About seventy-five acres of land that had formerly been in a crop and pasture rotation were divided and fenced off into nine equal plots. The first six were used exclusively for grazing. As checks, Plot 4 was unfertilized both seasons, and in 1929 Plot 6 received only phosphoric acid and potash. Plots 7, 8, and 9 were cut for hay in early June and then used for reserve pasture during the latter part of the season. In the early spring Nitrophoska II, a high analysis complete fertilizer, was applied. Calurea, a concentrated nitrogenous fertilizer was applied as a summer top-dressing three times during the season. The cattle were divided into groups—high producers, low producers, and dry cows and young stock—and were rotated from plot to plot, the first use of the fresh pastures always being available to the high producers who were followed in turn by the other two groups.

Accurate records were kept of the condition of the cattle, milk produced, additional feed consumed, and cost of all field operations. A daily record was kept for every plot of the number of each class of stock and the amount of milk produced. The day before the cows were turned onto a plot, grass samples were taken and analyzed for protein content by the Department of Chemistry. These were found to average 17.5 per cent crude protein in dry matter on the fertilized plots, as compared with 12.2 per cent on the plot which received no nitrogen.

Both pasture seasons have been abnormal; the first extremely wet and the second very dry. From the results obtained it is expected that a normal season will show much greater possibilities for the system; therefore, it is planned to continue the experiment.

The results so far seem to warrant the following conclusions:

1. A heavy, thick turf is essential for the best results from fertilizer application.
2. The application of fertilizer increases the quality and quantity of pasture grass.
3. Nitrogenous fertilizers are necessary for the greatest return, when a good pasture turf is established.
4. Proper management of the herd and plots, combined with fertilizer treatment, is essential for the greatest net returns from an intensive grassland system.

DEPARTMENT OF FARM MANAGEMENT

J. A. Foord in Charge

Enterprise Relationships and Farm Organizations on Selected Dairy Farms in Western Massachusetts. (R. L. Mighell). This project, begun in the latter part of 1928, has been continued throughout the year and quite complete records of the year's work on 19 selected dairy farms in the western part of the state have been obtained. Records of labor and its distribution, as well as of the financial and material income and outgo, have been secured and should yield valuable data when tabulations and comparisons are made.

The Place of Poultry Production on Massachusetts Farms. (R. L. Mighell and F. H. Branch). Work on this project was completed and the results published as Bulletin No. 251. (See list of publications).

Types of Farming in Massachusetts 1840-1925. (Marian Brown). This project was planned as a historical study to form a basis for future work. Most of the material and data had been collected at the time of Miss Brown's resignation in October, and will be prepared for publication by another member of the department.

Factors Responsible for Variations in Production and Cost of Milk in Massachusetts. (R. L. Mighell). Some progress has been made in reviewing the literature and accumulating data on this project, but more work must be done before definite conclusions can be reached.

Other Activities. The Department has cooperated with the State Department of Agriculture and the Massachusetts Industrial Commission in a business survey of Connecticut Valley farms, the planning and supervision of the field work being entirely cared for by this department. Records of approximately 350 farms, mostly those producing onions and tobacco, have been secured, and a careful tabulation and study are being made of the data.

FEED CONTROL SERVICE

Philip H. Smith in Charge

The Feed Control Service comprises not only feed inspection, but several other activities, as listed below:

Feed Control (General Laws, 1920, Chapter 94)
Seed Control (General Laws, 1927, Chapter 94)
Dairy Law (General Laws, 1920, Chapter 94)
Advanced Registry Testing
Miscellaneous Work

Feed Control. (P. H. Smith, H. R. DeRose, J. W. Kuzmeski, M. W. Goodwin[1], J. B. Zielinski, Jr., F. A. MacLaughlin). During the fiscal year, 1640 samples of feeding stuffs officially collected were examined in the control laboratories. The results indicate that guarantees placed upon these products are with few exceptions reliable, and that such lapses as occur are not serious. The retail feed business is gradually being absorbed by chain systems, which may in time seriously affect the revenue accruing to the State through the reduction of the number of brands of feeding stuffs sold. During the past year the gross receipts from this source were $19,800 derived from 990 registrations at $20 a brand. Of this sum, $11,000 is appropriated to the Experiment Station for the purpose of feed control.

Seed Control. (P. H. Smith, O. W. Kelly, C. L. Beane[2]). The seed laboratory has been established at the Experiment Station primarily for the purpose of inspecting seed samples collected by the State Commissioner of Agriculture, who is designated under the act as administrative officer.

[1]Resigned October 1, 1929.

[2]Resigned November 1, 1929, to accept the position of chief clerk in the Department of Botany.

The work accomplished during the two years that the law has been in operation indicates that, on account of the general good quality of seed offered, the laboratory can consistently devote less time to seed inspection and rather more time to research problems pertaining to seed.

Summary of Samples Analyzed, 1929

	Non-Official	Official	Total
Purity analysis only	27	55	82
Germination test only	228	181	409
Both purity and germination test required	131	249	380
Totals	**386**	**485**	**871**

In cooperation with the Department of Vegetable Gardening, 93 samples of onion seed were examined; and 31 samples of alfalfa and clover seed were submitted to the Department of Agronomy for field tests in order to determine trueness to type.

Dairy Law. (P. H. Smith, J. T. Howard, H. L. Allen). The work under this law involves:

1. The testing of Babcock glassware for accuracy.
2. The examination and award of certificates of proficiency in the use of the Babcock test.
3. The annual inspection of creameries, milk depots, and board of health laboratories where the test is used as a basis for fixing the value of milk and cream.
4. An amendment to the Dairy Law enacted at the 1929 session of the General Court authorizes the adoption of Rules and Regulations in order to promote uniformity and accuracy in testing. These rules and regulations have been published and distributed to operators. This amendment also makes possible investigation in order to determine if these rules and regulations are followed.

During the year ending December 1, 1929, 8515 pieces of Babcock glassware were tested. Condemned bottles amounted to less than one per cent of the total tested. Eighty-nine certificates of proficiency were awarded. One hundred and fifty-three creameries, milk depots and milk inspectors' laboratories were visited in order to check methods and pass upon equipment in use. As a result of this inspection, major repairs were ordered on 12 machines, minor repairs on 30, and 2 machines were condemned outright. Sealed glassware was ordered at four places, and cream scales at the same number.

Advanced Registry Testing. (P. H. Smith). At the present time the work of Advanced Registry Testing is cared for by the services of one clerk and seven supervisors. The volume of work does not change materially from year to year. In November, 1929, there were on test 568 cows, located on 78 different farms. Many of the pure bred cattle clubs are now giving recognition to Herd Tests in addition to the testing as it has been practiced in the past where individual animals of expected high production were selected for record work. The Herd Test is an incentive to breeders to maintain a high average production in their herds, with the consequent weeding out of inferior animals.

Miscellaneous work. (P. H. Smith, H. R. DeRose, J. W. Kuzmeski, J. B.

Zielinski, Jr.). Numerous analyses are made for residents of the State and other departments of the College. Analyses requested must be comparable to the general routine work of this department.

Summary of Miscellaneous Work, 1929

Materials sent in:	
Milk and cream, butter fat only	502
Milk, solids and fat	75
Feeds	97
Pasture grass, dry matter	562
Pasture grass, fodder analyses	45
Pasture grass, nitrogen	47
For other departments of Experiment Station and College:	
Milk for butter fat	127
Moisture tests, forage crops	706
Complete fodder analyses	192
Moisture tests and nitrogen	158
Chicken bones	2

FERTILIZER CONTROL SERVICE

H. D. Haskins in Charge

Fertilizer Inspection. (H. D. Haskins, H. R. DeRose, M. W. Goodwin, J. W. Kuzmeski, J. B, Zielinski, Jr.). During the season of 1929, 104 firms or individuals have registered in Massachusetts 638 brands of fertilizer, unmixed fertilizing materials and agricultural lime. The following table shows the nature of these materials as well as statistics with reference to their inspection.

Products	Brands Registered	Brands Collected	Samples Collected	Number of Analyses	Number of Determinations
Mixed fertilizers	365	347	1131	536	7341
Ground bone, tankage and fish	66	61	144	81	419
Nitrogen products, organic and mineral	78	69	229	143	440
Phosphoric acid products	33	30	102	42	231
Potash products	32	30	68	38	115
Dried pulverized natural manures	17	16	69	16	110
Miscellaneous materials	16	15	29	22	163
Lime products	31	30	62	35	267
Totals	638	598	1834	913	9086

In securing representative samples for the year's inspection, the four agents sampled 22,257 sacks or containers, representing 8285 tons of material; about 266 towns and 1005 agents were visited.

From July 1, 1928 to July 1, 1929 the following tonnages of fertilizer and plant food were sold in Massachusetts:

Fertilizer and Plant Food Tonnage

	Fertilizer	Plant Food Elements Available		
		Nitrogen	Phosphoric Acid	Potash
	Tons	*Tons*	*Tons*	*Tons*
Mixed fertilizers	41,529	1730	3206	2549
Unmixed fertilizer chemicals and materials	18,788	1115	1737	596
Pulverized natural manures	2,174	51	32	68
Totals	62,491	2896	4975	3213

Full details of the fertilizer and lime inspection work may be found in Bulletins 51 and 52, Control Series.

Miscellaneous Analytical Work. (H. D. Haskins, H. R. DeRose, M. W. Goodwin, J. W. Kuzmeski). Between November 1, 1928 and April 1, 1929, the activities of the department included cooperative chemical work with other departments of the institution. The general nature and extent of this work is shown by the following summary:

Soil, complete mineral analysis	20
Corn plants, complete ash analysis	9
Alfalfa, partial ash analysis	6
Timothy, partial ash analysis	4
Tobacco leaf, complete ash analysis	4
Tobacco leaf, dry matter and partial ash analysis	59
Tobacco stalks, dry matter and partial ash analysis	67
Soil, for carbon, nitrogen, carbonic acid, organic and volatile matter	26
Processed organic ammoniates, complete analysis including nitrogen activity tests	24
Manure, complete fertilizer analysis	4
Insecticides	2
Millet seed and straw, dry matter and nitrogen	96
Gladiolus bulbs, ash analysis	1
Ground seeds of plants, ash analysis	4

The department has also made the following analyses for farm organizations, institutional departments, and private individuals. For this latter service a nominal charge is made.

Fertilizers	21
Peat and pond deposits	22
Lime products	5
Pulverized manures	4
Cotton waste products	4
Mulch	3
Soils for partial analysis	23
Wool waste	2
Boiler sludge	2

In addition to the above, the department has cooperated as usual with the Association of Official Agricultural Chemists.

Vegetation Pot Experiments. (H. D. Haskins, A. B. Beaumont, G. J. Larsinos). This experiment, comprising 96 pots, was conducted in further

study of the nitrogen availability of processed low grade organic substances high in nitrogen which are used in mixed commercial fertilizers. Also, pots were included to note the effect of the use of varying amounts of manganese sulfate. Results of both experiments are reported in Control Bulletin 51.

DEPARTMENT OF HOME ECONOMICS RESEARCH

Esther Davies in Charge

Present Practices of Massachusetts Elementary Schools with Regard to School Feeding and Transportation and Their Effects upon Health of Pupils. (E. Davies and C. B. Church.). The field work for this project has been completed, most of the data tabulated, and a report of the findings with regard to food service has been prepared. The 222 towns of less than 5,000 population included in the study have a total elementary school enrollment of 57,600 pupils, 15,000 of whom must be furnished transportation to and from school. These towns have 800 school buildings: 370 one-room, 208 with two or three rooms, and 222 with four or more rooms. In 71 per cent of the buildings there is no food service of any sort at any time in the entire school year, and only one-fourth of the others have anything more than a haphazard service during the winter months. In general, the decision with regard to food service rests entirely with the individual teacher, and there is neither encouragement nor appreciation of her efforts on the part of the school administration.

Detailed records as to the cause and the duration of absences from school were kept by the teachers of 16 schools scattered throughout the State. The average number of days attended is greater for the children who walk to school than for those transported. The incidence of absence due to illness is the same for the two groups, but the illness absences of the transported group are of longer duration. The greatest difference between the two groups is in the amount of time absent from school in order to work at home. The transported group, either because of distance from the truant officer or because there are more tasks which can be delegated to the farm child, has three times as high a percentage of absence due to labor at home as has the group who walk to school.

The report gives an analysis of the situation now existing with regard to school feeding and transportation, and recommendations of improvements which might be made without appreciable added financial burden on the rural towns.

The Comparative Values of Milk and Tomato as Supplementary Feeding in a Rural Elementary School. (E. Davies and C. B. Church). This project was undertaken to determine to what extent the nutritional status of the elementary school child can be improved by school feeding, and whether—given the usual home diet of rural Massachusetts—milk or a vitamin C rich food is the better for the purpose. Work was begun in September, 1929, in the schools of a typical rural town, and the experimental feeding is to be continued for two school years. No conclusions can be reached before the end of the experimental period.

DEPARTMENT OF HORTICULTURAL MANUFACTURES

W. W. Chenoweth in Charge

The Extraction of Fruit Juices by Heat. (C. R. Fellers). This project has been continued, using small fruits including raspberries, blackberries (wild and cultivated), blueberries, currants, plums and grapes. With the experimental data complete, the results of the two-year study on small fruits will soon be presented as a bulletin.

The use of pectin in fruit jellies has been studied, and work has been done on a method for home extraction of pectin from cull apples or thinnings. In cooperation with the Department of Dairy Industry, the substitution of pectin for gelatin as an ice cream stabilizer was found to decrease overrun.

The use of frozen apples for cider making was found to be satisfactory, the expressed juice being very heavy and rich in pectin. This juice with added sugar gives an excellent cider jelly.

Manufacture and Preservation of Cranberry Products. (C. R. Fellers and F. P. Griffiths, W. W. Chenoweth). Several barrels of cranberries were canned in various types of tin cans and glass jars and some stored for a year at 90° F., 70° and 45°. The effect of cold storage upon the quality of canned cranberry sauce was very marked, the discoloration and abnormal flavor being very much reduced. A good cranberry sauce was found to jell at 216-218° F., contained approximately 43 per cent sugar, and showed a bloom jelly strength of about 150 grams. Close cooperation with the several cranberry packers and the State Cranberry Station at East Wareham has been maintained in this project.

The development of a cranberry syrup was attempted. It was found impossible to eliminate a very troublesome pectinous precipitate from the syrup. The condition was remedied somewhat by using a very short extraction period and expressing the juice before all of the pectin had been liberated.

Candied cranberries were made in the laboratory and seem to be in many ways superior to the commonly used candied cherries.

Utilization of Onions by Canning. (C. R. Fellers). Further progress has been made, particularly in methods of preparation of onions for canning. A short blanching (1.5—3 min.) in boiling water loosens the outside skin and greatly facilitates its removal. The use of zinc enamel-lined tin cans to prevent a black or smut formation has again proved very efficacious. The onion contains much loosely combined sulfur which is liberated during the canning process and combines with metals of the container to form sulfides. Since zinc sulfide is white, there is little objection to it.

Work on onion pickling and drying has been continued. Several pounds of onion powder for flavoring foods was prepared. It is believed this product has good commercial possibilities.

The Nitrogen Distribution of the Edible Portion of the Onion. (F. P. Griffiths). The total nitrogen and various amino acid fractions were estimated. The Van Slyke separation method was used.

Utilization of frozen fruits in ice cream. This joint project carried on in the departments of Dairy Industry and Horticultural Manufactures is

now in its second year. Two fruit crops consisting of strawberries, raspberries, blackberries, cherries, and peaches have been cold packed with various ratios of cane and corn sugars, stored at 15°F., and used in fruit ice cream mixes. The most satisfactory varieties of strawberries were Howard 25, Howard 17, Bliss, King Edward, Beacon, First Quality and Marshall, while Herbert, Cuthbert and St. Regis varieties of raspberries were very suitable for cold packing. The optimum fruit to sugar ratio was 2 to 1 and 3 to 1 for strawberries and cherries and 3 to 1 for raspberries and peaches. Corn sugar discolored the fruit and was unsatisfactory. Fruits frozen without sugar lost, to a considerable degree, their characteristic fresh flavor and color. Prompt freezing at 0°F. followed by cold storage at 15°F. or less kept the fruit in good condition for over a year. Such frozen fruit was comparable to fresh fruit for use in ice cream, jams, jellies, and juices.

Pasteurization of Dried Fruit. (C. R. Fellers and J. A. Clague). Research has been conducted on the heat treatment of dried fruits, particularly dates and figs, with the view of developing an effective pasteurizing procedure for these products. A preliminary report on this work is now in press (*American Journal of Public Health*). A heat treatment of 180° F. for 60 minutes at 75 per cent humidity will effectively destroy *Escherichia coli* in packaged dates and actually improves the quality, texture, and color of the fruit.

Non-Project Research. (C. R. Fellers). The canning of citrus juices, the fermentation and preservation of citron, and a preliminary study of cider preservation with benzoates have been carried on.

DEPARTMENT OF LANDSCAPE GARDENING

Frank A. Waugh in Charge

Lawns and Lawn Grasses and Lawn Management. (L. S. Dickinson). As the summer of 1929 was unusually dry, important observations have been made concerning the advisability of fertilizing turf during a hot dry season. Excellent turf of each of the basic grasses—bent, Kentucky blue grass, and fescue—has been maintained by monthly applications of castor bean pomace or cottonseed meal. Check plots receiving no fertilizer were severely dried, thus permitting an invasion of weed growth.

Additional field studies have been made of the fungus causing snow mould, and laboratory experiments have been conducted during the summer concerning the large brown patch disease (*Rhizoctonia solani*). These experiments verified the field observations, and it now appears that an attack of this disease can be accurately forecast.

Seven species of grasses imported from Germany are being tried as fairway grasses, and there have been many strains of bent added to the trial plots. Also, several strains of bent have been discarded, as they did not appear to be adapted to putting conditions.

The series of plots established in the fall of 1928 in cooperation with the United States Golf Association wintered very well, and while only one year old they are furnishing many data. In this series the annual blue grass and European red fescue plots were much affected by the hot dry season.

Approximately one acre more land has been assigned to turf culture studies. This will be used for variety plots, turf nursery, and student plots.

DEPARTMENT OF PLANT AND ANIMAL CHEMISTRY

J. B. Lindsey in Charge

The Efficiency of Copper Fungicides. (E. B. Holland and others). A summary of the laboratory work relative to the preparation of low and high basic copper sulfates and of the composition and physical characteristics of the laboratory and manufacturers' samples has been presented in Bulletin 254 together with the results of several year's field tests of their efficiency as fungicides, both as sprays and dusts, in the control of diseases on cucumbers, celery, potatoes and fruits. The project is held in abeyance awaiting further developments of the subject.

Supplements for Copper Fungicides. (E. B. Holland and others). Data from many experiments made at this Station, both in the laboratory and in the field, pertaining to the use of supplements for incorporation into different copper fungicides intended to remedy some real or fancied defect have been published in Bulletin 252, to which the reader is referred for full information.

The Effect of Fertilizer and Cultural Treatment on the Nitrogenous Compounds of Havana Seed Leaf. (P. R. Nelson). The work on tobacco originally undertaken by E. B. Holland and continued by P. R. Nelson endeavored to measure the effect of varying amounts of nitrogen, high and low topping, and different stages of maturity on the nitrogen compounds of "seconds" grown on the experiment plots during the season of 1928. This is a sub-project of the Department of Agronomy and is further reported by that department.

Oil Sprays. (E. B. Holland). A study of oil sprays has been undertaken with the view of determining the relative composition of the different brands of stock emulsion and miscibles that have been employed by the Department of Entomology. An effort is being made to produce similar products of definite composition for field tests. Definite results are not yet available for publication.

Nitrogen Fixation in the Presence of or as a Result of the Growth of Legumes versus Non-Legumes Under Certain Defined Agronomic Conditions. (F. W. Morse). The crops produced this year (1929) were red clover for a legume and timothy for a non-legume. They were the second year's product from the seeding in the spring of 1928 described in last year's report. Both lots wintered well. Conditions were favorable for growth until early in June, after which there was little rainfall. The crops were cut, sampled and weighed on July 1 and 2. They were a repetition of those produced in 1924, therefore a comparison of results for the two seasons is of interest. The comparison is made between the products of the areas that have not received nitrogen in fertilizers since 1882.

Dry Matter and Nitrogen Removed from the Plots
(*Kilograms per Acre*)

	Dry matter		Nitrogen	
	1924	*1929*	*1924*	*1929*
Clover, Plot 7	1552	1712	43.2	41.2
Clover, Plot 9	1868	1838	49.9	41.9
Grass Plot 7	408	508	3.4	4.9
Grass Plot 9	496	623	4.5	6.1

The particularly interesting result is that after an interval of five years of continuous cropping and removal of nitrogen, the soil which has not grown a leguminous crop in that period held its own and something more, measured by both dry matter and nitrogen in the crops removed this year.

Chemical Changes in the Cranberry During Ripening and After Harvesting. (F. W. Morse). The work during the past year has been principally the analysis of numerous varieties of cranberries and samples from different bogs. Numerous specimens of the 1929 crop have been received from New Jersey and Wisconsin cranberry growers, as well as from the Cape Cod region. At this time it is possible to report nothing more than the range of percentages found by the determination of total acid, total sugar and dry matter in the varieties so far examined.

Ten varieties of the crop of 1928 were received from Cape Cod growers in November of that year. During October and November of this year, there have been analyzed 41 varieties of the crop of 1929 which were representative of all three states—Massachusetts, New Jersey and Wisconsin. The results expressed as minima and maxima so far observed are as follows:

	Dry Matter %	Total Sugar %	Total Acid %
1928 10 varieties	11.3-13.1	3.45-5.22	2.14-2.79
1929 41 varieties	11.2-13.5	2.50-5.45	2.07-2.71

The much wider range in percentages of sugar in 1929 was probably due to a wide variation in the maturity of the fruit when harvested. The study of cranberries during ripening has shown that sugar is rapidly increased during the last week on the vines, accompanied by a noticeable development of color of the berries. Several samples of this year's crop were very light colored, and the lowest percentages of sugar were found among them.

Record of the Station Herd. (J. B. Lindsey and J. G. Archibald). This project has been carried on over a long period of years incidental to other work. The records for 1928 show that twelve cows (ten grade Holsteins, one grade Jersey, and one pure bred Jersey) completed a normal lactation period during the year. The average production was 9045 pounds of milk testing 12.27 per cent solids and 3.8 per cent fat, with a feed cost per cow of $164.97, or 4.01 cents per quart of milk. Feed cost was based on hay at $20, silage at $8, green feed at $8 a ton, and grain at market price. Under conditions prevailing it was not practicable to determine the overhead.

In 1929 the herd included 20 cows milked during the year. A number, however, had only short lactation periods, varying from a few days to six months. The records of ten cows having normal lactation periods are as follows: Average yearly production 8534 pounds, testing 12.40 per cent total solids and 3.97 per cent fat, with a feed cost of $143.63 per cow, and 3.70 cents per quart of milk. The feed cost of roughage was figured on the same basis as for 1928, with grain at prevailing market prices. The feed cost of milk was a little less in 1929 than in 1928 due, in a measure, to the increased use of roughage and less grain.

Milk Substitutes in the Growing of Young Calves. (J. B. Lindsey and J. G. Archibald). Results of work on this project over a period of several years have recently been published in Bulletin No. 253. The method which has been the most satisfactory compromise between economy and good growth has involved the use of skim milk powder in limited amount (about 125 pounds per calf) up to four months of age.

The project is being continued with the idea in mind of developing a system based largely on dry feeding after the first few weeks, little or no liquid except water being fed.

Mineral Supplements for Dairy Cattle. (J. B. Lindsey and J. G. Archibald). The final report of six years' investigation of this subject has recently been published in Bulletin No. 255. Little, if any, benefit was noted from the feeding of bone meal. Some slight benefit was noted from feeding dicalcium phosphate (precipitated bone), but not sufficient to warrant recommendation of its general use. Average producing cows (5000-8000 lbs. yearly) fed on good quality roughage with the amounts of grain ordinarily fed in New England seem to obtain sufficient mineral matter from their ordinary feed. Heavy producers may benefit from the addition of mineral supplements, but the efficacy of the practice is by no means well established.

Mineral Constituents of Forage Crops. (J. B. Lindsey and J. G. Archibald). Results of this project form a part of the above-mentioned Bulletin No. 255. No pronounced deficit of mineral constituents has been noted in the Massachusetts roughages examined in the course of this work. The calcium content of the hays analyzed is worthy of note, it being somewhat higher than the values given by other authorities.

Mineral Requirements for the Growth of Dairy Heifers. (J. B. Lindsey and J. G. Archibald). Work on this project, organized about three years ago, is being actively pursued. At date of writing (December, 1929) eight heifers have been carried through two years of intensive experimental trials, four on a ration high in calcium, and four on a ration low in that element. An accurate check has been kept on the intake and excretion of calcium and phosphorus by these animals, and careful growth records have been kept. The work has not yet reached a stage where definite conclusions are warranted. Of necessity it must be a long-time project.

A Comparison of Two Systems of Dairy Cattle Feeding—High Roughage and Low Grain vs. Low Roughage and High Grain. (J. B. Lindsey and J. G. Archibald). This project was organized a year ago in order to obtain some definite experimental evidence on a problem which is much discussed by practical feeders and on which various recommendations

have been made from time to time, but without a definitely established basis of fact.

The Station herd has been divided into two groups, one receiving grain at the rate of one pound to four and one-half pounds of milk, 40 pounds of silage and what hay they will clean up; the other group receiving grain at the rate of one pound to two and one-half pounds of milk, 25 pounds of silage and what hay they will clean up. The cows are being carefully observed, and the usual checks on live weight each month, milk production, and the reproductive function, are being maintained. It is too soon to draw definite conclusions from the trial. The plan is to continue it for at least three lactation periods of all the cows.

The Chemical Composition of Grass from Plots Fertilized and Grazed Intensively. (J. G. Archibald). The department has cooperated during the past two years in a study of an intensive system of grassland management being carried out on the College farm. A study has been made of the chemical composition of grass as affected by the intensive fertilizer treatment and grazing which the system involves. Results for 1928 have been published in the *Journal of the American Society of Agronomy* for June 1929. The study for 1929 has not yet been completed. Briefly: the fertilizer treatment increased the percentage of nitrogen, phosphorus, and ether extract, and decreased slightly the percentage of crude fibre and calcium, in the dry matter of the grass. Acre production of all constituents was increased, nitrogen being nearly doubled, while phosphorus and ether extract were increased by about one-half.

A study of the seasonal variations in composition showed that grass kept in the vegetative stage by grazing may be quite different in chemical composition in midsummer from what it was in the spring. The seasonal factors, rainfall, temperature and sunshine, exert their influence irrespective of the stage of growth of the plant.

Utilization of Onions by Canning. (C. P. Jones). The object of the studies on the chemistry of the onion has been to ascertain (1) its mineral and proximate food constituents, (2) the cause of its discoloring action upon the tin in which it is processed, and (3) the reason for the darkening of the onion itself in the canning process. Many of the inorganic and organic constituents of the onion have been already determined. Further additions relative to both are to be made.

Discoloration of Can. Preliminary studies made on the discoloration of plain tin cans by commercially processed fruits, vegetables, flesh products and soups, and by laboratory canned materials indicated that sulfur from the protein molecule caused the discoloration. Experiments conducted with cysteine hydrochloride further confirmed this view. In the case of the onion, other sulfur compounds are present in addition to those associated with the protein molecule, and were therefore considered as possible discoloring factors.

Unfortunately, lack of laboratory facilities prevented the extraction, recovery and consequent identification of the sulfur oils contained in the onion. However, several analogous oils (technical alkyl sulfide and disulfide, allyl sulfide, and mustard oil) were investigated as to the probability of such sulfur compounds constituting discoloring agents. This was found not to be the case, with the exception of mustard oil. The presence of

mustard oil would result, through decomposition, in the discoloration of the can to some degree.

Tests indicated that the metallic film formed on the sides of the can was a sulfide of tin rather than of iron.

Black deposits occurring on the head space end of some enameled cans were removed and tested for their metallic constituents. Both iron and zinc were found present. Zinc oxide is a constituent of the enamel coating. The amount of iron obtained indicated other forms besides the sulfide, presumably oxides.

Discoloration of the Onion. In all cases canned onions were found to be normal both in firmness and color when removed from the can, while the onion liquor was of a pale green color. Exposure to the air or to the influence of oxidizing agents resulted in the development of a dark olive green color of tissue and to a dark green to brown coloration of the liquor, regardless of whether the product was processed in plain tin or enameled cans. Onions processed in glass, on the other hand, when exposed to the same oxidizing conditions, discolored slowly, changing in color to a light brown only upon long standing. This pronounced difference in color between onions processed in glass and those canned in tin was believed to be due to the influence of soluble iron.

Examination of the liquor from both the plain and enameled cans proved the presence of considerable ferrous iron in solution. Much more iron was recovered from the liquor of the plain can than from the enameled can.

A flavonol pigment, probably quercetin, was proved to be present in the onion bulb. It was found distributed throughout the fleshy inner tissues as well as in the dried outer scales. Experiments carried out with commercial quercetin showed that ferrous ions failed to produce any colored compound, whereas ferric ions resulted in the formation of an olive green to reddish brown ferric compound and also reddish brown solutions depending upon the proportion of iron to pigment.

These investigations indicate that the discolored film produced upon the sides of the plain can in the processing of the onion is due to the formation of sulfide of tin, the source of the sulfur being the sulfur compounds of specific proteins; while the black deposit occurring on the head space end of some enameled cans was largely iron, part as a sulfide and part as oxide. The discoloration of the onion itself is due probably to the presence of iron and quercetin or a similar pigment in solution. The development of the discoloration is believed to involve the following steps: First, metallic iron from the can is rendered soluble by the action of oxygen contained within the head space of the can and also by the solvent influence of the acids and salts of the onion; secondly, the ferrous iron thus formed reacts with the pigment forming the ferrous compound of the pigment; and finally, this ferrous iron, when exposed to the atmosphere, oxidizes and forms an olive green ferric derivative of flavonol.

DEPARTMENT OF POMOLOGY

F. C. Sears in Charge

The Interrelation of Stock and Scion in Apples. (J. K. Shaw and J. S. Bailey). The usual records of growth, bloom, and yield of the trees in the eleven-acre orchard have been taken during the year. The trees have responded to increased applications of nitrate of soda with better growth, and the 1930 crop should be somewhat greater than the rather small crops of previous years. The grass has been suppressed over a space about five feet in diameter around the tree trunks in an effort to prevent girdling by mice. No such injury has appeared since this practice has been followed. Inasmuch as the lease of this land expires in two years, it is probable that the report on this project will be held until the expiration of the lease. No new tendencies have appeared in the past year.

The orchard set in 1928 consisting of McIntosh and Wealthy trees on Clonal stocks from the East Malling, England, Experiment Station, have made a good growth, it being necessary to replace only two trees. It will, of course, be several years before any report can be made of the comparative value of these stocks for the two varieties used. It seems as though there may be possibilities for commercial orchards on these stocks which may be expected to produce semi-dwarf trees which will come in bearing early, thus reducing the capital investment in an orchard at the start of production.

Root cuttings from several of these stocks were set in the spring of 1928 and were large enough to bud the second season. In order to make this method of propagation practical, it must be shown that they have considerably greater value than seedling stocks. Probably the more usual method of mound layering is preferable. It is planned to dig the several hundred of these stocks now in the nursery rows in the spring of 1930, increasing them so far as possible and establishing a new nursery for layering these stocks.

Tree Character of Fruit Varieties. (J. K. Shaw and A. P. French). A study of varietal characteristics of nursery trees continued the past summer, largely in connection with the work of the leaders of this project in certifying varieties for the Massachusetts Fruit Growers' Association. More than two million trees were examined. Substantial progress has been made in determining characteristics for the identification of sweet cherry varieties, and it is now thought possible to detect mixtures of cherry varieties with a fair degree of certainty. This should be valuable, as cherry varieties have been badly mixed in the nursery. Little work has been done with pear and plum varieties for there is at present little demand for these fruits. There are few serious difficulties in variety identification. The problem of peach variety continues troublesome, and yet there is enough known to detect many mixtures and misnamed trees.

A variety nursery was established in the spring of 1929, and grafts and buds of more than one hundred varieties of apples are included. These include all the varieties of apples that are extensively grown in American nurseries, also many new varieties that may have a place in the near future. A few varieties of peaches were also included. It is planned to make a critical study of these varieties as one-year trees in 1930 and as

two-year trees in 1931. The photographic method will be used, and it is felt that real progress can be made in recording various differences so they may be understood by anyone familiar with nursery trees.

The Genetic Composition of Peaches. (J. S. Bailey). The orchard of about 1200 selfed and cross-fertilized seedlings planted in the spring of 1928 made satisfactory growth during the past season, and only a very few trees died. Few studies were made the past season, but with the trees in good growth it is expected that studies will be made the coming summer. Some additional work in crossing varieties was done the past summer, but for some unknown reason very few fruits were secured.

The freezing apparatus designed for use in the study of fruit bud hardiness in connection with this project has been completed and considerable data have already been accumulated bearing on the killing point of buds of different varieties and on the effect of various conditions on the killing point. This work is slow and painstaking, and considerable time will be required before sufficient data can be accumulated to warrant definite conclusions.

Testing Methods of Pruning. (J. K. Shaw). This project has been continued the past year, but no attempt to summarize the results has yet been made. No obvious differences have appeared in the quality and quantity of the fruit borne on the heavy pruned, light pruned, and unpruned trees.

Effect of Pruning on Bearing Apple Trees. (F. C. Sears and J. K. Shaw). The past season was the third year of this experiment on old bearing trees. There seems to be a slight though not very consistent increase in size of fruit on the heavy pruned trees. The fruit from these trees is graded according to the State Grading Law each year, and notes of size, color development, and various insects and diseases have been made. No striking differences have appeared; yet the data must be carefully examined before safe conclusions can be drawn.

Comparison of Cultivation and Sod in a Bearing Orchard. (J. K. Shaw). The experimental program as modified in 1927 has been continued. Where nitrate of soda has been used on trees in cultivation without fertilizer, there was distinct increase in yield. Whether a midsummer application of nitrate of soda has increased yield is yet uncertain. The same may be said relative to the sod plot which has for the past three years received potash in addition to nitrogen.

The fertilizer test in the orchard formerly devoted to the study of head formation has continued as for the past four years. No careful study of data has been made, but it seems clear that the nitrogen has improved the trees, although perhaps the unfertilized plots show better performance than one would expect from trees on rather poor soil which has been without fertilizers since the planting of the trees in 1916.

Comparison of Clover Sod and Grass in Sod Mulch Orchard. (J. K. Shaw). This project is a comparison of a complete fertilizer with phosphorus, potash and lime designed to bring in a sod of white clover which may be expected to furnish nitrogen for the trees. The white clover appeared first in 1927 and has been slowly spreading, as the fertilizer treatment has been continued. The trees with complete fertilizer con-

tinue to yield more heavily, but it will be interesting to see what happens if the white clover spreads over the entire area of the plot.

Test of Different Amounts of Nitrate of Soda. (J. K. Shaw,). This test on thirty-year-old Baldwins in sod has continued as in the past. No injury to the trees has yet resulted from the use of twenty-five pounds of nitrate of soda per tree. Owing to the small number of trees involved in this experiment, a considerable number of years will be required before it is safe to draw any conclusions.

Comparison of Cultivation and Heavy Mulching for Apples and Pears. (J. K. Shaw). This experiment has been continued as in previous years. The mulched trees continue to yield heavier crops and no injurious effects of the large amount of nitrates in the soil under the mulch have been observed. There seems to be a heavier drop from the trees on the mulch plot just before harvesting, but this is not very serious as the apples are little damaged and may be sold for good prices. It is felt that the system of mulching trees with enough hay or straw to suppress the growth of grass around the trees has possibilities in Massachusetts orcharding.

The Effects of Fertilizer Limitation on Fruit Plants. (J. K. Shaw). This project has been continued as in previous years and nothing new has appeared during the past season. Owing to the fact that the trees, now seven years old, must have sent their roots beyond the boundaries of the plots which are only ten feet wide, it is planned to remove these trees and reset the area with other trees on uniform roots. While the differences between plots have been marked, there are also very great differences between individual trees on the same plot.

Role of Potash and Lime in Fruit Tree Nutrition. (J. K. Shaw). The study of the soils on the orchards referred to in the previous paragraph by means of experiments carried out in Wagner pots, has been continued. Soil from the field plots was placed in the pots after various fertilizer chemicals had been mixed in the soil. The general question of whether the beneficial effects of potash and lime observed in the field were genuine has again been answered in the affirmative, although not quite as emphatically as last year.

Addition of nitrate of soda to soil from the potash plots failed to increase growth as much as lime; therefore, it seems that the increase of soil nitrates in plots receiving lime cannot be the sole cause of improved growth. It is planned to continue this study next year.

Effect of Potash and Lime on Apple Trees. (J. K. Shaw). This project is carried out in an orchard planted in 1915 and involves comparisons of nitrate of soda, potash, superphosphate, and lime, alone and in various combinations. Certain plots are fertilized so as to establish a sod of white clover. This has been successful in many cases and seems to have been beneficial to the trees. Still the trees receiving nitrogen have yielded better than those without, although the difference is not great. No superiority of color of apples from plots receiving complete fertilizer over those from plots receiving nitrogen alone has been observed. In general there is a tendency for plots receiving nitrogen to be inferior in color to those receiving no nitrogen from fertilizers. Observation in this orchard

must be continued for several years longer before final conclusions can be drawn.

Study of Varieties of Tree Fruits. (J. K. Shaw and O. C. Roberts). The observations on many varieties of tree fruits growing in the College orchards, which have been carried on for several years, were continued this year. With the accumulation of a considerable number of years' records, it should be possible to make some deductions as to the relation of climatic conditions to bloom and yield.

Fruit Bud Formation in the Strawberry. (R. A. Van Meter). This project was started in the spring of 1928 to study the effect of soil nitrates on fruit bud formation and on fruit production. Forty-five plots of thirty plants each were established in 1928, involving nine fertilizer treatments replicated five times, as given in the last annual report. No differences were observed in the appearance of plants on the different plots either during the summer of 1928 or in the spring of 1929 prior to fruiting. The summer of 1928 was moist and all plots grew well.

At harvest time the fruit from each plant was checked and graded for size. Differences between treatments were slight, but there seemed to be a consistent difference in favor of the later applications.

A new series of forty-five plots of sixty plants each was established in the spring of 1929. These are in nine series, treated as follows:

1. No nitrates
2. August 5, nitrate of soda
3. August 16, nitrate of soda
4. August 16, sulfate of ammonia
5. September 3, nitrate of soda
6. September 16, nitrate of soda
7. September 16, sulfate of ammonia
8. October 4, nitrate of soda
9. October 22, nitrate of soda

Nitrate of soda was applied at the rate of 309 pounds per acre, and sulfate of ammonia at the rate of 232 pounds per acre. Superphosphate at the rate of 600 pounds per acre and muriate of potash at 150 pounds per acre were worked into the soil along the rows immediately after planting. All plants made an excellent growth, and no differences between plots were observed during the summer.

Work not on a Project Basis. As in previous years, work has been done along lines not definitely classified under the various listed projects. This is mostly by members of the Pomology Department not on the Station Staff. The principal work along these lines is briefly mentioned.

The "Set" of McIntosh Apples in Middlesex and Worcester Counties. In the spring of 1929 county extension services and certain growers in these two counties reported that McIntosh apples failed to set properly and asked for assistance from the Experiment Station. Prof. Bailey and Mr. Roberts spent some time in these two counties cooperating with the county agents in studying this situation. Considerable data were collected and these indicated that the set was not as poor as had been reported. This observation seems to be supported by the fact that the crop at harvest was at least fair. The McIntosh is one of the varieties that blooms rather freely every year, but suffers a severe early drop. In this

respect it stands in sharp contrast to the Baldwin, Wealthy, and many other varieties. In most years a light set of McIntosh is not serious, but in years when the set is naturally rather light, it results in serious limitation of the crop. The problem is a complicated one and it is planned to undertake some co-operative tests with various growers in these two counties in the season of 1930. It is believed that in this way information can be assembled that will help point the way to improved practices that may lessen the danger of light crops in years when the variety fails to set well.

A Study of the Storage of McIntosh Under Various Conditions. (O. C. Roberts in co-operation with C. I. Gunness of the Agricultural Engineering Department). The purpose of this study is to determine the relationship between temperature and the satisfactory storage of McIntosh apples. In conducting this experiment the apples were picked at various stages of maturity and placed in storage rooms with the temperatures at 45°, 40°, 32°, and air-cooled storage respectively. As a result of this experiment it is hoped that the maximum temperature at which McIntosh may be held satisfactorily will be determined.

Cross-Pollination and Sterility Studies with Certain Apple Varieties. (F. C. Sears, O. C. Roberts and others). Work on the cross-pollination of apple varieties was continued this year along similar lines as reported previously. McIntosh, Cortland and Northern Spy were used as the pistillate varieties. The pollen varieties included the McIntosh, Delicious Wealthy, Early McIntosh, Cortland, and Macoun. The last three, representative of McIntosh seedlings, were used especially on McIntosh. The results of this season's work showed Early McIntosh and Macoun as being of doubtful value as pollinizers for McIntosh, while Cortland was more satisfactory than the other two. However, the performance of Cortland was not as good as the previous year.

The effectiveness of the use of bouquets of suitable varieties on the set of McIntosh was studied. Two McIntosh trees were covered with tobacco cloth tents to exclude the possibility of natural pollination. A hive of bees was placed under each tree. Then a bucket containing a bouquet of Delicious, Wealthy, and Ben Davis flowers was placed in one of the trees, while in the other tree no pollen varieties were provided. The tree in which the bouquet was placed set approximately five times as many apples as the tree without the bouquet.

Studies of the Arsenical Residue on Apples. (O. C. Roberts cooperating with the Department of Entomology, and the Boston Federal Food, Drug, and Insecticide Administration). A study of the arsenical residue on apples has been continued this year as formerly with a few slight modifications. Dusts have been used in the later applications to determine if the use of such materials would control the pests and at the same time avoid an excessive deposit of arsenical residue. This appears to be a promising procedure.

DEPARTMENT OF POULTRY HUSBANDRY

J. C. Graham in Charge

Broodiness in Poultry. (F. A. Hays). The intense broody and the non-broody lines are being continued, and a considerable number of recessives lacking both genes for broodiness have appeared. As previously pointed out, there is some difficulty in increasing the population of recessives because of high mortality record. The wide variability in degree of broodiness in the broody line is receiving special attention at this time. The degree of broodiness in the flock as a whole has been reduced very significantly: first, by reducing the percentage of broody birds, and second, by decreasing the number of broody periods per individual.

The average length of the broody period has remained constant at fifteen days, throughout the history of the flock. The flock of 1927 showed only 9.5 per cent of the birds going broody as pullets. This places the flock on the same basis with respect to the broody trait as the White Leghorn.

Breeding Poultry for Egg Production. (F. A. Hays and Ruby Sanborn). The mean annual egg production of the 552 birds hatched in 1927 was 197.3 eggs. This flock was superior to previous flocks in early maturity, intensity and non-broodiness, but was slightly deficient in persistency. Records would indicate that the average decrease of eight eggs per bird was due to lack of persistency and to modifying environmental influences. The flock hatched in 1928 showed a very significant increase in vigor as measured by mortality rate in the laying house, the mean mortality rate for this flock being 14.85 per cent. The most significant increase was observed in flock hatchability for the spring of 1929, the mean percentage of fertile eggs hatched being 78, the highest in the history of the flock.

Age at first egg, body weight at first egg, high intensity and low broodiness have been well established in the flock. At the present time especial effort is being made to establish by genetic methods a flock lacking the winter pause and breeding true for genetic high persistency and high hatchability, together with maximum vigor.

Statistical Study of Heredity in Rhode Island Reds. (F. A. Hays and Ruby Sanborn). The data on the effects of inbreeding upon fecundity, covering a period from 1923 to 1928, have been assembled and submitted for publication as a Station bulletin. Eleven years' records on growth rate in Rhode Island Reds have also been assembled and are ready for publication as a Station bulletin.

A Genetic Study of Rhode Island Red Color. (F. A. Hays). Considerable progress has been noted in the establishment of desirable plumage color in the egg-laying strain of Rhode Island Reds. In the spring of 1929 a small flock of standard-bred Reds was obtained and will be used as a check against the Station strain in color breeding studies.

Determination of Genetic Laws Governing Results in Inbreeding Poultry. (F. A. Hays). A study, carried on for five years, of the effects of different degrees of inbreeding upon fecundity was concluded on March 1, 1929, and submitted for publication. The project is being carried on at present using as a foundation birds measuring up to the highest

possible standard in characteristics affecting fecundity. The matings of 1929 consisted of sire on daughters in three different groups. The matings of 1930 will be made up using half-brothers and sisters. The same rigid standard for selection will be employed as long as the experiment continues.

Heredity and Environmental Characteristics Affecting Variability in Egg Production. (F. A. Hays). Data are now being accumulated under this project, and the second-year group of daughters are now housed to be tested for laying. The selection of the 1929 breeding stock was within the three lines established by the 1928 matings.

Factors Governing Egg Weight and Shell Character in Domestic Fowl. (F. A. Hays). The matings for 1929 in this project were made between individuals hatched in 1928 from the small, medium and large egg groups. The daughters hatched in 1928 from the mothers laying 52-gram eggs or 53-gram eggs in December did not show a significant difference in mean winter egg weight. On the other hand, the daughters from the mothers averaging 59-gram eggs in December showed a winter egg weight very superior to that of the other groups.

Egg weight in the entire flock has shown a very significant increase in the last two years. The flock hatched in 1928 reached a 24-ounce average in February. Egg weight records are now available for a complete year on 225 birds. A paper entitled the "Inheritance of Egg Weight in the Domestic Fowl" was published in the *Journal of Agricultural Research* for May 1, 1929.

Relation of Intensity or Rate of Laying to Feather Pigmentation. (F. A. Hays). Sufficient data under this project will be available next year for study. In a general way there appears to be considerable relation between intensity and shade of pigmentation in the Rhode Island Red.

DEPARTMENT OF VEGETABLE GARDENING

(Market Garden Field Station, Waltham)

Frank A. Waugh in Charge

Conditions Affecting the Production and Vegetative Propagation of Washington Asparagus. (V. A. Tiedjens). During the 1929 season investigations on the vegetative propagation of asparagus were continued. One-year-old roots weighing 160 pounds a thousand, and having crown bud development indicating high potential yielding power, were divided into two, three, four, and five or more crown sections. The results may be summarized as follows:

	Number planted	Number of skips	Number of stalks per plant	Average weight of roots *Grams*	Condition of growth
Whole crowns	144	0	8.4	88	Uniform height
Crowns cut in two	52	0	6.2	74	Uniform height
Crowns cut in three	52	3	5.8	62	Some variation
Crowns cut in four	78	17	6.1	50	Some variation
Crowns cut in five or more	26	2	5.5	61	Some variation

The skips in the above table are within reason except perhaps in the crowns cut in quarters. In this lot the number of skips is greater than usual. The size of the roots from the cuttings compares very favorably with the whole roots. Some of the roots from the cuttings were fully as large as the roots from the uncut crowns.

Due to the distribution and variation in size of buds on the crowns, it is impossible to make divisions so that each section from the same crown will have buds of equal size. The first buds developed on a seedling crown are much smaller than those developed late in the growing season. The small buds left over from the early seasonal growth are more or less dormant and will not produce as large a root growth as the sections having the larger buds that were developed late in the growing season. However, the potentialities for large root development are probably uniform for all the sections coming from the same root. The size of the buds on the cuttings is not necessarily correlated with the size of the stalks that follow. The size of the stalk is determined by the amount of stored food reserves in the roots attached to the section of the crown planted. The stalk may, therefore, be much smaller in diameter than the bud from which it came. The distribution of the buds on the crown determines where the crown may be divided, and thus the number of roots to the section is determined before the cutting is made. The plants that die may be accounted for by the section of the crown that they represent.

This method of propagation is feasible and applicable to commercial conditions. By this method it is possible to grow seedlings properly spaced, select 1,000 of the best out of every 10,000 roots, and increase these by crown cuttings to 3,000 or 5,000.

Comparison of Size of Roots.—A comparison between 100 two-year roots. 100 selected one-year roots, and 100 cull roots gave an average of 6.7 stalks per plant for the two-year-old roots, and 7.4 stalks for the selected one-year roots. The same number of skips, 3 per cent, was counted in each plot. In the plot of 100 cull roots the number of stalks per plant was 5.4, with 20 per cent skips. There was a big difference in height of stalks between the cull and selected one-year roots in favor of the selected roots. The two-year roots produced stalks slightly higher than the selected one-year roots.

Stem Cuttings.—An attempt was made to make stem cuttings on one and five-year-old plants. Cuttings were made from the stems below the branches having dormant buds and from the spears which had not broken open. These cuttings were grouped in four series, subjected to the following treatments, and placed in moist, sterile sand in a propagating frame.

Series I—Lot 1 immersed one hour in 3.8 per cent nitrate of soda solution; lot 2 immersed one hour in 1 per cent sodium thiocyanate solution; lot 3 immersed one hour in 3.8 per cent nitrate of soda solution plus 1 per cent corrosive sublimate solution; lot 4, check.

Series II—The time was increased to 2½ hours.

Series III—The same as Series II but the cut ends were sealed with low temperature paraffine.

Series IV—Immersed 6½ hours.

The spears in most cases decayed even when treated with corrosive sublimate, and proved very unsatisfactory as a source of material. None of the cuttings produced any signs of root growth, but considerable stem growth was made. The buds on the older part of the stem, that ordinarily are permanently dormant under field conditions, were stimulated to growth by the various treatments but did not show any material advantage over the check cuttings. Sodium thiocyanate for one hour was the most promising. Stalks from the one-year plants gave 30 to 50 per cent repsonse regardless of treatment, while the stalks from five-year-old plants gave 10 to 16 per cent response in growth of dormant buds. Sealing the ends of the stems gave no material difference except to make growth slower. There was considerable difference in bud and stem growth between cuttings from one and five-year plants.

On the whole the results were interesting but gave no information on root growth. The work will be continued another year along the most promising lines.

Plant Progenies.—Selecting from individual plant progenies for higher yielding plants was continued in the Martha and Mary Washington varieties. Thirty-three lots of seed, each lot representing a plant, were planted in the field in August, 1928, and a duplicate lot planted in the greenhouse February 8, 1929. Both were transplanted in the field in April, 1929, for comparison. The roots were spaced four inches apart. They were the same size in both cases, but the greenhouse lot was transplanted with green tops. The selections sown in the field varied from 51 to 100 per cent stand, while the greenhouse lot varied from 8 to 73 per cent stand. The average number of stalks per plant was 4.5 for the greenhouse lot and 5.8 for the field lot; the average number of stalks per plant varied from 3.0 to 6.8 for the various selections. This difference is probably an indication of the inherent vigor of the various mother plants.

There is a feeling among growers that the stalks of the Mary Washington variety break over more readily than the other varieties. This was noticeable in the plant progenies, for 7 out of 12 Mary Washington selections showed a sprawly growth, while none of the 39 Martha Washington selections showed the sprawly condition. This, apparently, is a weakness in the Mary Washington variety.

Number of Seeds to the Berry.—The average number of seeds to the berry varied from three to five in the different selections. A few berries on some plants had seven and eight seeds. The weight of 100 seeds varied from 1.6 grams to 3.2 grams.

The seed from one plant was grouped in six lots according to the number of seeds in the berry and was planted. The visible growth and percentage stand were best in the lot of seed coming from the two-seed berries. The seed of each lot was weighed, and the weight of 100 seeds decreased consistently from 2.6 grams for the single-seed berry lot to 2.0 grams for the six-seed berry lot.

The seed from three other plants was divided into four sizes with sieves. The weights in each case decreased as in the previous example. In each case the second heaviest, and the second largest seed, gave the most vigorous appearing plants. For a comparison, field run seed was screened into four sizes and planted with the four plants mentioned. In

this group the growth made from the first and second largest seed was similar and did not show any advantage for the second largest seed, as was the case in the seed from the four plants. The consistency of this vigor in the second largest seed between the four plants seems to be significant and will be investigated further.

The results indicate the fallacy in comparing the effect of size of seed on plant growth by using field run seed. The variation in size of seed between plants makes it imperative that studies of this nature be conducted with seed from the same plant.

Field run seed was divided into large, medium, and small and planted three inches apart by hand in rows. The average stand (4 rows of each lot) was 61 per cent for the large seed, 70 per cent for the medium seed, and 64 per cent for the small seed. The consistency in stand in the individual rows of each lot makes the difference significant. The average number of stalks per plant for the three lots was not significantly different nor was there any difference in root growth.

Depth of Planting.—Two hundred selected one-year roots were planted 2, 4, 6, and 8 inches deep in 1928. The preliminary results are summarized in the following table:

Depth of planting	Skips	Number of plants		
Inches	%	Vigorous	Medium	Weak
2	2	165	28	3
4	9	144	30	8
6	17	120	33	13
8	30	65	38	37

These results were obtained on a medium silt loam with a gravelly subsoil. Four to six inches seems to be the best depth of planting to give a good growth and have the roots deep enough so that the surface can be cultivated in the spring.

Relation of Depth of Planting Seedlings to the Angle of Crown Growth. Seedlings starting their first storage roots were transplanted to the experimental plot. After a season's growth the roots were dug and the angle of inclination for the crown growth measured.

Depth of planting Inches	Sand	Medium sand and loam	Loam
1	—14.0°	—11.6°	—16.6°
2	—10.0°	—5.8°	—1.9°
3	+6.0°	+7.1°	+1.6°
4	+11.0°	+17.0°	+6.4°

The results show that the optimum depth for planting seed was between 2 and 3 inches for the three types of soil. At that depth the new buds on the crown developed horizontally. Shallower than 2 inches, the buds tended to develop below the horizontal plane, whereas at greater depths the buds developed above the horizontal plane.

Fertilizer Studies.—In the spring of 1929 fertilizer experiments on asparagus were started in Waltham, Concord, and Eastham. Five acres are devoted to the plots. A comparison of fertilizer ingredients, time of application of fertilizers, amounts of fertilizers to apply, relation of high phosphoric acid to maturity, and relation of fertilizer to earliness, are

the main problems being investigated. Although there were variations between the plots at the end of the 1929 season, there was no correlation between the variations and the treatment of the plots. There was no consistency between duplicate and triplicate plots. The extremely dry season made it possible to locate the favorable spots in the field which were probably due to moisture.

Cold Resistance in Sweet Corn in Its Relation to Quality, Size, and Earliness. (V. A. Tiedjens). Breeding a cold resistant early yellow sweet corn was continued. A large number of ears were selected from a selfed lot of first generation seed. Considerable earliness has been incorporated in the Whipple Yellow strain used in the cross. Many of the F_1 selections were mature from two to ten days before the Whipple Yellow parent, and were fully as large.

Greenhouse Lettuce. (V. A. Tiedjens). Three pounds of the Bel-May greenhouse lettuce seed grown in 1929 were parceled out to growers in small quantities. Preliminary reports from the growers show this lettuce to be superior to Belmont and May King for greenhouse forcing.

Improvemenet of Vegetable Varieties Through Root and Seed Selection. (V. A. Tiedjens). Selection of foundation stock for the Field Station selection of the Wyman beet and Hutchinson carrot was continued. The demand for the Hutchinson carrot seed this year exceeded the supply by 400 pounds.

Thirty-one lots of Dwarf Horticultural beans from as many seedsmen, and fifteen lots of French Horticultural beans were compared, preliminary to establishing uniformity for these two varieties. Much mixture was found in most of the samples. Ten of the lots which showed some promise were saved for further study. There was considerable difference in earliness and susceptibility to drought between the two varieties.

Five samples of Blue Hubbard squash were secured for self-pollinating to establish a uniform variety of Blue Hubbard. A strain of Green Hubbard from the Vermont Experiment Station was grown and found to be very uniform for type characteristics. The season was not conducive to their development, however, so that the squash were under size. This was also true of the Blue Hubbard varieties.

The Genetics of Greenhouse Cucumbers. (V. A. Tiedjens). The work on this project has progressed along lines reported previously. Some crosses having commercial possibilities are being compared.

A new selection producing no pistillate flowers during the summer months and only an occasional pistillate flower during the winter months has been isolated and is being studied in crosses to determine how prevalent the sterility may become in commercial houses. The factor for this character probably had its origin in the English variety and may account for low yielding plants in commercial houses, as most of the commercial varieties carry some English "blood".

Bitter Cucumbers. Preliminary studies have been made on the relation of fertilizer treatment to bitter cucumbers. Nitrate of soda, urea, calurea, and calcium nitrate were compared with and without manure. The plants were grown in half barrels, and the chemicals were applied as top-dressing every two weeks. The first cucumbers were picked April 20, and the first bitter cucumbers occurred after May 10. The tubs receiving no

manure gave 31 per cent bitter cucumbers, while the manure tubs gave 42 per cent bitter cucumbers, with no difference between the chemical treatments. There was some correlation between bitterness and growth. Of the fancy fruit, 30 per cent were bitter; of the wasp shaped types 35 per cent were bitter; and of the seconds and nubbins 50 per cent were bitter. Generally, the more time that was required to mature the fruit, the greater was the possibility that it would become bitter. There was no correlation between the location of the cucumber on the vine and its flavor. Bottle-necked cucumbers had a 75 per cent chance of being bitter near the stem end.

DEPARTMENT OF VETERINARY SCIENCE

J. B. Lentz in Charge

The Cutaneous Vaccine for Fowl Pox. (N. J. Pyle). From the eighth to the twenty-first day following the use of vaccines, egg production was slightly decreased. In birds 68 days of age, gain of weight indicated that growth was not seriously affected and that the weaker vaccine appeared to be as efficient as the stronger, "standard" vaccine. An immunity duration of at least 371 days was established. Attenuation of the vaccine appeared to be associated with its glycerol content. Details of this work are in the printer's hands.

Laboratory Service—Pathology. (G. L. Dunlap). This service was used by 284 persons, of which number 112 made personal calls, either delivering specimens or discussing the reports of examination.

Of the 1,055 specimens examined, 1,002 represented poultry and the remainder consisted of other domesticated animals. Approximately one-fourth of the poultry specimens harbored intestinal parasites, led by coccidia. Avian tuberculosis and fowl cholera were entirely absent in the material submitted.

Trichuris ovis, a sheep parasite, and tetrameres, a poultry parasite, are being reported for the first time from this laboratory.

A diagnostic fee of two (2) dollars, to be paid before a report is issued, is associated with this service. Failure of payment accounts for 26 unclaimed reports.

This service deserves credit for valuable assistance given to the pullorum disease testing work.

Poultry Disease Elimination Law. (W. R. Hinshaw and E. F. Sanders; H. Van Roekel and K. L. Bullis). Control Series Bulletin 48 reports the 1928-29 Pullorum Disease Testing Season. Compared with the 1927-28 season, the respective increases are: 72,001 agglutination tests, 63,861 birds tested, 92 flocks, 90 negative flocks, and 72 flocks 100 per cent tested and negative. Similar comparison shows the average infection to be reduced 2.27 per cent.

The proper age to start testing birds has received some attention. Preliminary results, obtained from a limited number of flocks, seem to show that the disease can be eradicated just as efficiently when testing is begun before laying, as when testing is postponed until the flock is in production.

Among the reasons for failure to eradicate pullorum disease the following were found to have been operating in some Massachusetts flocks: not all birds on the premises were tested, retesting at intervals during the season was not practised, chicks which were hatched before the test had been completed were raised, positive birds were not removed from the flock (109 reports studied showed 84 positives left in 26 flocks), infertile eggs from untested flocks were fed, custom hatching with no discrimination against untested flocks was practised, and purchases were made without careful investigation regarding the pullorum disease status of the flock of origin.

The progress of this work has been due to no one particular factor. Poultrymen, extension workers, administrative officers, and members of the laboratory staff have appreciated the value of cooperative effort. During the year the laboratory has received 188 visitors, who wished either to discuss their own individual problems or to prepare themselves to assist other poultrymen. The Seventeenth Annual Poultry Convention, during the 1929 Farm and Home Week, gave an entire afternoon to this subject, and over 250 persons showed that close, personal contact of all concerned improves the service.

At this time no definite conclusions can be made regarding the 1929-30 season. The month of October, with over 100,000 tests, surpassed the record of any single previous month in the laboratory's history. The advantages of this early testing, to both the poultrymen and the laboratory, are so evident that no discussion is required.

Farm and Station Bang's Disease. The laboratory, in assisting this project, has recorded 972 agglutination tests.

PUBLICATION

General Bulletins

247 Biennial Report: For the Fiscal Years Ending Nov 30, 1927 and 1928. 55 pp. February, 1929.

The main purpose of this report is to provide an opportunity for presenting in published form, recent results from experimentation in fields or on projects where progress has not been such as to justify the general and definite conclusions necessary to meet the requirements of bulletin or printed manuscript.

248 Tomato Leaf-Mold: The Use of Fungicides for Its Control in Greenhouses. Guba, E. F. 24 pp. March, 1929.

The culture of greenhouse tomatoes is an important industry in Massachusetts, and the area devoted to this crop has increased considerably in recent years. Leaf-mold is the most serious disease affecting the crop. The loss of one to two months of pickings of the fall crop and one month of the spring crop as a result of this disease is common. Past recommendations regarding the proper choice of fungicides for its control are conflicting and not based on experimental evidence, and growers who have used fungicides have not obtained control. This investigation has considered the merits of different types of fungicides. An effective material, and a practical method of application, have been discovered which are recorded in this bulletin.

249 The Plum Curculio in Apples in Massachusetts. Whitcomb, W. D. 28 pp. March, 1929.

The plum curculio is the most injurious insect pest of apples in Massachusetts, frequently damaging more fruit than all other insects together. As a result of

the heavy loss to fruit growers, studies of this insect were begun in 1926 in the eastern part of the State, and this bulletin reports the progress of the work to date.

250 The Consumer Demand for Apples. Jefferson, Lorian P. 18 pp. April, 1929.

The purpose of production is the satisfaction of the requirements of consumers. In order to meet them efficiently, it is necessary to know the character and extent of the demand. This type of investigation has received comparatively little attention, but the importance of such information becomes increasingly evident. It was in the hope of benefiting both grower and dealer that this study was undertaken.

251 Causes of Differences in Poultry Profits. Mighell, R. L., and Branch, F. H. 19 pp. May, 1929.

Records based on experience in poultry farming show wide differences in financial returns. It is assumed that these differences can be attributed to certain specific practices and conditions which may be subject to control or modification. This study was undertaken to determine the extent to which the various factors and conditions operated and were effective in influencing profit in the industry.

252 Supplements for Copper Fungicides. Holland, E. B., Dunbar, C. O., and Gilligan, G. M. 20 pp. June, 1929.

Ever since copper fungicides were introduced, numerous supplementary products have been recommended for incorporation in the spray with a view to remedying some real or fancied defect. The contradictory evidence presented by different investigators relative to various supplements may be due in part to differences in amount of substance employed, in method of preparation and of application, but more often to an insufficient number of replications with different crops under varying weather and soil conditions. The use of supplements is not warranted unless they reduce infection and consequent economic losses. This study was undertaken to determine the intrinsic and relative values of the materials recommended for use as supplements.

253 Milk Substitutes for Calves. Lindsey, J. B., and Archibald, J. G. 9 pp. July, 1929.

The production of milk for near-by consumption is the principal industry of Massachusetts dairymen. The maintaining of the herd is an ever-present problem. Some farmers prefer to purchase mature milkers and others to rear calves from their own cows. This Station has been studying the most economical and satisfactory method of growing the calf until four months of age, and presents the results of its findings in this bulletin.

254 The Preparation and Effectiveness of Basic Copper Sulfate as a Fungicide. Holland, E. B., Dunbar, C. O., Gilligan, G. M, and Doran, W. L. 27 pp. June, 1929.

Copper fungicides have been a subject for investigation during the past few years. This work comprises a study of chemical composition, physical characteristics and general effectiveness in field work, together with the use of various supplementary products. The main objective was the preparation of a Bordeaux substitute that could be readily suspended in water and used as a spray, or mixed with a free-flowing carrier and applied as a dust. The product must give a practical control of disease but not necessarily equal to a highly dispersed Bordeaux of the same copper content. The advantages of such a product in the saving of time, labor and equipment in preparation, and the gain in uniformity and stability of the spray mixture are evident. Since basic sulfates are generally considered preferable to basic carbonates, attention has been directed largely to them.

255 Studies in Mineral Nutrition. Lindsey, J. B., and Archibald, J. G. 16 pp. November, 1929.

It was formerly held that the dairy animal obtained sufficient mineral matter from the roughages and grains consumed. More recently, based on some experimental evidence, this opinion has been questioned, and many have advised

the feeding of supplementary minerals in the form of ground bone, ground limestone and the like. In order to get additional light upon the subject, this Station has conducted experiments with growing and mature dairy animals and presents its findings in Part I of this bulletin.

As a part of the work, many determinations were made of the mineral constituents of the grains and roughages fed, and likewise of the amount found in the ordinary roughages grown in different sections of Massachusetts. These analyses are brought together in Part II of this bulletin.

256 The Cost of Government in Massachusetts, 1910-1926. Yount, Hubert W., and Sherburne, Ruth E. 68 pp. November, 1929.

The rapid increase in demand for public service, together with the resulting increase in taxes, has placed a severe strain on farmers in many Massachusetts towns. This study analyzes the costs of public service in such towns compared with larger towns and cities, and points out the more important handicaps under which small towns operate.

257 The Cutaneous Vaccine for Fowl Pox. Pyle, Norman J. 20 pp. December, 1929.

Investigation of fowl pox at this Station has for its purpose the determination of an efficient preventive and curative treatment for the disease. This is of vital importance to the Massachusetts poultry industry because the disease causes serious loss by decreasing egg production during the season when eggs are highest priced.

The study of the cutaneous vaccine, as here reported, included investigations of its efficiency, its practical use and method of administration, its action on body weight, temperature, and early egg production, and the duration of immunity which followed its administration.

258 Inbreeding in Relation to Egg Production. Hays, F. A. 48 pp. December, 1929.

For many years inbreeding has been successfully used in establishing poultry breeds where foundation stock was available only from very diverse sources. In recent years, however, work in this field has been confined largely to flocks of an established breed, and the value of inbreeding from such restricted foundation stock is questionable. The experiment here reported was planned to show the effect of various degrees of inbreeding within a so-called established breed—in this case Rhode Island Reds.

259 Rate of Growth in Rhode Island Reds. Hays, F. A., and Sanborn, Ruby. 20 pp. December, 1929.

In selecting birds for various purposes, poultrymen make extensive use of body weight as an index of the characteristics desired. The weight records presented in this report cover an eleven-year period on all living individuals in a flock bred primarily for high fecundity and show something of their significance. The results may serve as guides to the weights which may be expected in this breed if high fecundity is the chief goal, when methods of management and climatic conditions are comparable.

Control Bulletins

44 Inspection of Commercial Feedstuffs. Smith, Philip H., and others. 28 pp. November, 1928.

45 Inspection of Commercial Fertilizers. Haskins, H. D., and others. 47 pp. December, 1928.

46 Inspection of Agricultural Lime Products. Haskins, H. D., and Goodwin, M. W. 6 pp. December, 1928.

47 Seed Inspection. Smith, Philip H., and others. 11 pp. February, 1929.

48 Eradication of Pullorum Disease in Massachusetts, 1928-1929. Hinshaw, W. R., and others. 36 pp. July, 1929.

49 Seed Inspection. Smith, Philip H., and others. 55 pp. October, 1929.

50 Inspection of Commercial Feedstuffs. Smith, Philip H. 33 pp. November, 1929.

51 Inspection of Commercial Fertilizers. Haskins, H. D., and others. 61 pp. November, 1929.

52 Inspection of Agricultural Lime Products. Haskins, H. D., and DeRose, H. R. 8 pp. December, 1929.

Meteorological Reports

481-492, inclusive. Monthly reports giving daily weather records with monthly and annual summaries.

Reports of Investigation in Journals

(Numbered Contributions)

82 The Inheritance of Egg Weight in the Domestic Fowl. Hays, F. A. Jour. Agr. Research 38:511-519. May 1, 1929.

83 The Mineral Constituents of Cranberries. Morse, Fred W. Jour. Biol. Chem. 81:77-79. Jan., 1929.

84 Effect of Heat on Malic Acid. Morse, Fred W. Jour. Amer. Chem. Soc. 51:1276-1279. April, 1929.

85 Lime Penetration Resulting from Surface Application to Pasture Land. Nelson, P. R. Soil Science 27:143-146. Feb., 1929.

86 A Water Culture Technic for Studies in Tobacco Nutrition. Beaumont, A. B., and Larsinos, G. J. Jour. Amer. Soc. Agron. 21:150-155. Feb., 1929.

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Utilization of Cold Packed Fruits in Frozen Dairy Products. Fellers, C. R., and Mack, M. J. Fruit Products Jour. 9:8-11. Sept., 1929; 9:46-47. Oct., 1929.

A Canned Grapefruit Defect. Fellers, C. R. Canner, Oct. 19, 1929.

Glass Packed Chicken. Fellers, C. R., and Griffiths, F. P. Glass Packer 2:315-318. Aug., 1929.

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CHANGES IN STAFF, DECEMBER 1, 1928, TO NOVEMBER 30, 1929

Appointments

Bullis, Kenneth L., D.V.M., Assistant Veterinary Pathologist, Poultry Disease Elimination Law, October 28, 1929.

Gibbs, Charles S., M.S., Ph.D., Assistant Research Professor Veterinary Science, November 4, 1929.

Hughes, Mary C., Laboratory Assistant, Pomology, October 28, 1929.

Lindsey, Adrian H., Ph.D., Professor, Agricultural Economics, September 1, 1929.

Shilling, Katherine E., B.S., Laboratory Assistant, Agricultural Economics, April 1, 1929.

Van Roekel, Henry, M.S., D.V.M., Chief of Laboratory, Poultry Disease Elimination Law, August 13, 1929.

Zielinski, John B., Jr., B.S., Junior Chemist, Fertilizer Law, October 1, 1929.

Resignations

Barton, Rena L., Laboratory Assistant, Pomology. Died August 22, 1929.

Brown, Marian V., B.S., Research Assistant, Farm Management, October 12, 1929.

Dufresne, Virginia R., A.B., Laboratory Assistant, Agricultural Economics, March 1, 1929.

Goodwin, Marvin W., B.S., Junior Chemist, Fertilizer Law, September 30, 1929.

Griffiths, Francis P., B.S., Research Assistant, Horticultural Manufactures, transferred to Instruction March 1, 1929.

Hinshaw, William R., M.S., V.D.M., Chief of Laboratory, Poultry Disease Elimination Law, July 31, 1929.

Nelson, Paul R., M.S., Research Assistant, Plant and Animal Chemistry, September 21, 1929.

Pyle, Norman J., V.M.D., Assistant Research Professor, Veterinary Science, September 30, 1929.

Sanders, Ellmore F., D.V.M., Assistant Veterinary Pathologist, Poultry Disease Elimination Law, October 12, 1929.

Waite, Clifton B., Collector of Blood Samples, Poultry Disease Elimination Law, September 30, 1929.

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THE M. A. C. BULLETIN
AMHERST, MASSACHUSETTS

VOLUME XXIII FEBRUARY, 1931 NUMBER 2

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REPORT NUMBER

MASSACHUSETTS AGRICULTURAL COLLEGE

THIS ISSUE OF THE BULLETIN CONTAINS THE REPORT OF THE PRESIDENT AND OFFICERS OF ADMINISTRATION FOR THE YEAR ENDING NOVEMBER 30, 1930, WHICH IS A PART OF THE SIXTY-EIGHTH ANNUAL REPORT OF THE MASSACHUSETTS AGRICULTURAL COLLEGE AND AS SUCH IS PART I OF PUBLIC DOCUMENT 31. (SECTION 8, CHAPTER 75 OF THE GENERAL LAWS OF MASSACHUSETTS)

PUBLICATION OF THIS DOCUMENT APPROVED BY THE COMMISSION ON ADMINISTRATION AND FINANCE

3m-1-'31. No. 1023

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MASSACHUSETTS AGRICULTURAL COLLEGE

REPORT OF THE PRESIDENT TO THE BOARD OF TRUSTEES, 1930

A review of the year just passed shows marked progress in the development of this institution. We have again exceeded previous records for student enrollment. The curriculum has been improved by changes made in course requirements. Many of the departments of the College, notably Physical Education, have made significant advances in the services which they are rendering to students and to other citizens. The physical equipment of the College has been greatly improved. Such progress has been made possible by hearty cooperation between faculty, trustees and all who have a part in the functioning of this College. I wish, therefore, to express my keen appreciation of this cooperative spirit and I believe I may well congratulate the Board of Trustees upon the progress made under their supervision.

REVIEW OF THE YEAR

Changes in Staff

There have been twenty-four resignations from the professional staff during the year of which fourteen were from the instructional staff, nine from the station staff and one from the administration staff. The retirement from active service of Professor Henry T. Fernald was an important loss to the College. Because of the many responsibilities which he carried considerable reorganization has been necessary. This is described in a following paragraph. Professor Fernald gave long and valuable service to the College coming here in 1899 to be Professor in the newly organized Department of Entomology. Pioneer work in this field had already been done at this College by his father, Dr. C. H. Fernald, who was Professor of Zoölogy for more than twenty years. The work of both of these scientists has gained national prominence and their students have taken important responsibilities not only in this country but in foreign lands. Professor Fernald has been appointed Professor Emeritus of Entomology.

Laurence R. Grose resigned on August 31 as Professor and Head of the Department of Forestry after ten years of service in this position. Robert P. Holds-

worth was appointed Professor of Forestry in his place. Professor Holdsworth is a graduate of Michigan State College and of the Yale School of Forestry. He comes to this College from the University of Arkansas where he has been Professor of Forestry.

Enos J. Montague resigned on September 30, as Head of the Farm Department and Assistant Professor of Animal Husbandry, terminating twelve years of valuable service to the institution. He has been largely responsible for the development of the splendid flocks and herds which the College now owns. Clarence H. Parsons, a graduate of this College in 1927, has been appointed to take Professor Montague's place.

We have been particularly successful this year in locating well trained persons to fill the numerous vacancies caused by resignations from our staff. The necessary reorganizations have been accomplished without upsetting the work in progress. I feel, therefore, that, although changes in staff have been numerous, the work of the institution has progressed in a surprisingly satisfactory manner.

Changes in Departmental Organization

During the year, the Department of Animal and Dairy Husbandry was divided into two Departments to be known as Animal Husbandry and Dairy Industry, with Professors V. A. Rice and J. H. Frandsen named as the respective heads of these new departments.

Later in the year, Professor V. A. Rice was made also Head of the Division of Agriculture, to fill the vacancy caused by the transfer of the former head of the division to other administrative duties as mentioned below.

Upon the retirement on July 1, of Dr. H. T. Fernald who had been serving as Director of the Graduate School, Professor of Economic Entomology and Head of the Department of Entomology, and Entomologist of the Experiment Station, a considerable reorganization of these administrative duties was put into effect. The position of Director of the Graduate School was combined with that of Director of the Experiment Station, in charge of Director F. J. Sievers, and he was relieved of his former duties as Head of the Division of Agriculture. The position of Head of the Department of Entomology was combined with that of Head of the Department of Zoölogy and Geology and Dr. C. E. Gordon made Head of the combined department; at the same time C. P. Alexander was promoted to the professorship in Entomology and made administratively responsible for the section of resident teaching in Entomology, and A. I. Bourne to the research professorship in Entomology with administrative responsibility for the Experiment Station work in this field.

Student Enrollment

Again, as in 1928, I have to report the largest student enrollment in the history of the College. For the first time, more than 700 students are enrolled in degree courses and the total enrollment in full-time courses numbers 950, of which 710 are in college and graduate courses and 240 in the Stockbridge School of Agriculture. The freshman class of 239 students is the largest ever enrolled. It is apparent, therefore, that last year's falling off in enrollment was not an indication of a permanent trend in the demand for higher education of the type which this College provides.

The renovation and remodelling of North College dormitory has come just in time to take care of this substantial increase of students. While it has not provided much additional accommodation on the campus it has provided for a majority of our freshmen and the upper classmen who have been pushed out have discovered additional accommodations off campus. For example, two more fraternity groups have purchased houses and other fraternities are housing more students than heretofore. How much more private facilities will continue to absorb a growing student population here is problematical. It has been felt often in the past that these facilities have been taxed to the limit and yet they continue to take care of our increasing numbers.

Our move this year to house on the campus as many freshman men as possible has already proved so successful from an educational and social point of view that

I believe we should plan to house all freshmen in campus dormitories as soon as possible regardless of private facilities available. It is possible that this will be the full extent to which we will need to go to provide housing for our students. I am convinced that this much, at least, is fully justified and needed.

Student Enrollment in Major Courses

The question is frequently asked as to whether or not students are forsaking the agricultural courses offered at the College. In an effort to investigate this matter, I have compared in the following table the enrollment of students in major courses during three widely separated periods.

Major specialization in the junior and senior years began in 1903 and in the table below is given the enrollment of major students in the principal divisions of the curriculum for that year.

In 1917 the interest in agriculture of students in the four-year degree course was greater than it has been since the war. The table shows the enrollment of junior and senior students in the major courses during that year. In 1918, there was established at the College a two-year course in practical agriculture, now known as the Stockbridge School, which has enrolled in 1930, 240 students all in agriculture and horticulture. In 1930 for the first time, freshman students elect their major course of specialization. The table, therefore, shows for 1930 the enrollment of all resident undergraduate students at the College in the various subject matter fields in which they are specializing.

Student Enrollment in Major Courses

Courses	1903		1917		1930	
	Number of Students [1]	Per Cent	Number of Students [1]	Per Cent	Number of Students [2]	Per Cent
Agriculture	14	30	58	33	154	18
Horticulture	19	40	42	24	259	30
Physical and Biological Sciences	14	30	37	21	231	26
Social Sciences and Humanities	–	–	40	22	178	20
Home Economics	–	–	–	–	53	6

[1] Includes juniors and seniors only. Freshmen and sophomores did not indicate major specialization.
[2] Includes all classes in four-year degree course and also students in two-year Stockbridge School course.

This table shows that a very substantial proportion of the students at the College (48%) are now pursuing a major course of study in the fields of agriculture and horticulture, that about the same proportion as in the past are specializing in the physical and biological sciences and that the proportion majoring in social sciences has not changed significantly since 1917. Because of increased total enrollment more students are specializing in agriculture and horticulture today than ever before, although the percentage is about the same as when specialization was first permitted.

The Collegiate Course of Study

Historically, this College has had only one curriculum and granted only one undergraduate degree (Bachelor of Science). In this curriculum, the work of the freshman year and most of that for the sophomore year has been uniform for all students. Specialization in the junior and senior years was formerly by departments but some years ago was changed to "divisional specialization" in order to insure some breadth of training in the upper years, at least from the standpoint of faculty advice.

Three unfortunate results of this situation have grown increasingly apparent in recent years and the Course of Study Committee of the Faculty has been giving careful study to this matter during the past two years. These three difficulties are as follows:

(*a*) The existence of only one curriculum, or route to the baccalaureate degree, has made it necessary to report all our students as pursuing the same course of study and that, of course, has been called a course in "agriculture." This has had many unfortunate effects, most of which have been frequently cited as arguments for a change in the name and scope of the College.

(*b*) The fixed curriculum of the freshman year has served as an excellent preparation for further study and a splendid introduction to the opportunities at the College for instruction in the physical, biological and social sciences, but has given the freshman students no contact with the teaching faculties or opportunities for further study in agriculture, horticulture and home economics. From this viewpoint the freshman curriculum has given a distorted introduction to the college courses.

(*c*) Most modern professional education requires some practice or methodology courses in the junior and senior years, based upon subject matter knowledge acquired in preceding courses. Our former procedure of making the first two years' work chiefly general, thus limiting the acquirement of special subject matter to the junior and senior years, has prevented the possibility of methodology courses in these years. Recently, a very active demand has arisen for teacher training courses, for courses in methods of extension work, for farm management experience courses, etc. The present curriculum affords no place for these.

The Course of Study Committee of the Faculty gave very careful consideration to these several aspects of the problem and finally recommended that specialization begin in the freshman year, to the extent that one of the five required courses in this year vary with the student's major interest. A plan to put this into effect was submitted by the Committee to the Faculty at a special meeting called to consider this matter and held on May 13. After extensive discussion, the faculty voted unanimously to recommend the new plan to the Board of Trustees for approval. The Board of Trustees, at their meeting on June 16, approved the general principles involved, with the understanding that certain details with reference to designations of fields in which a degree might be earned would be subject to further consideration as experience develops or new situations arise.

A brief general statement concerning the collegiate course of study as now organized follows.

The course of study consists of four years of work planned to provide scientific foundation, cultural background, and professional training, and leads to the degree of Bachelor of Science (B.S.). The following five different major lines of specialization are provided: Agriculture; Horticulture; Home Economics; the Physical and Biological Sciences; and the Social Sciences.

The work of the freshman year consists of definitely required subjects, most of which are identical for all students, in order to insure a uniform preparation in the more fundamental collegiate subjects. However, some differentiation is required in order to properly introduce each student to some major line of work in which he may find his professional interest, and major faculty contacts.

The work of the sophomore year is also largely prescribed in order to insure as broad a cultural background as possible in preparation for the more specialized training of the last two years. Under the guidance of a major group advisory committee the student begins in this year certain optional choices of electives leading to the special courses of major work which he will later pursue.

The work of the junior and senior years is, with certain restrictions, elective under the guidance of a special adviser, who is a member of the advisory committee of the major group which the student selects during his freshman year as his field for professional training.

Development of the Physical Education Program

In anticipation of the availability of the facilities of the new building, the Physical Education Department has developed a sound and comprehensive program the objectives of which have been stated by the department as follows:

1. To acquaint the student with his physical condition through adequate medical examinations.
2. To provide activities which are scientifically sound and satisfactory to the individual.
3. To place students in activities in keeping with their physical condition.
4. To provide corrective exercise for those with health handicaps.
5. To institute an enlarged health service and further its intelligent use in preventing illness.
6. To control environment so that positive health habits may be formed.
7. To provide definite teachings which will result in activity along health lines.
8. To encourage and give credit for physical activities pursued at other times than regular class hours.
9. To provide a program of intramural athletics which will include both recreational and team games.
10. To create habits, attitudes and appreciations of physical exercise that will be of life-long value to the individual.
11. To develop an appreciation of the proper relationship between athletics and the other activities of the institution as a whole.
12. To bring about an understanding of the physiological laws of life to the end that right habits of living will be an enduring and continuous process.
13. To lead to the correct interpretation of health in its broadest phase as including mental hygiene, emotional stability and social adjustment.
14. To emphasize health not only because of its intrinsic value to the individual but as a means to a fuller efficiency in life and service.

Much of this program has already been put into operation with very satisfactory results. Four terms of work are required of freshmen and sophomores of which at least one term must be in team games. The classes are organized into teams and leagues; captains are chosen and each team plays through a full season as a definite organization. Instruction is also given in such games as golf, tennis and volley ball which offer valuable recreation opportunities for after-college days when the more strenuous team games are out of the question. This program has been enthusiastically received by the students and is giving a splendid training to them.

Intramural and varsity athletics have been promoted and supervised as in the past. Soccer has been added to the program of intercollegiate athletics. Varsity, freshman and Stockbridge School teams have played regular schedules in football, basketball, hockey, baseball and track which has been the means of giving to a large number of our students practice and training in sportsmanship and team play. During the year, also, 33 teams of 253 players took part in interfraternity contests in soccer, baseball and basketball. Twelve teams of 80 players took part in interclass contests in baseball, hockey and basketball. It is a reality on this campus that "there is a team for every man."

In addition to the general program described, nine elective courses are offered in the field of physical education theory and practice. The purpose of these is to train men who can take charge of the physical education program in secondary schools, not only to coach athletic teams but to develop a recreational program to meet the needs of all students. There is a real need for men with this ability particularly in the smaller high schools where the work is combined with other teaching responsibilities. Courses in education offered by other departments of the College together with these offerings of the department of Physical Education make possible a very adequate training for this work and more than fifty graduates of the College are now engaged in it.

One further activity of this department which deserves mention here is the en-

couragement and support which it is giving to athletics in the smaller high schools in Western Massachusetts. It conducts each year an invitation basketball tournament, a track and field meet and an interscholastic relay. Senior students with adequate training and experience are also made available as officials for interscholastic games through an approved officials service conducted by the department.

With the splendid facilities of the new building soon to be available, we shall be able to carry on a program of physical education here which, I am sure, will be a great service to our students and also aid substantially in promoting a sound program of physical education in the smaller secondary schools of the State.

Student Health Service

With the approval of the Board of Trustees, during the past summer arrangements were made for the establishment of a student health service at this College beginning with the current academic year. Dr. E. J. Radcliffe, a graduate of the College of Medicine of the University of Toronto, was employed as college physician to be in charge of the new service.

This new service will provide, in addition to the instruction in hygiene, physical measurements of entering students, and temporary first aid services formerly rendered by the college nurse, regular courses of instruction in corrective physical exercise, diagnostic and advisory medical service to students who fall ill and advice and assistance with reference to the food habits and rooming conditions of our students.

It is not contemplated that the college physician will carry on actual medical practice in cases of illness but that he will be able to give first aid treatment for minor injuries and illnesses and will recommend students to the care of a regular practicing physician whenever in his judgment it is necessary or desirable that this be done.

It is also planned that the student health service shall promote a regular plan of improvement of health conditions of students in cooperation with the other activities of the physical education department to which department this new service is assigned as a section.

At the outset, it is necessary to charge each student a small fee to cover the cost of the installation of this new service which was not otherwise provided in the budget. There is a possibility that future budgets may be provided whereby the Commonwealth will finance the cost of this most desirable training of that group of its citizens who attend this College as students.

There are many evidences that this new service has been accepted and used with enthusiasm by many of our students and the indications are that it will prove a most valuable aid to the general welfare of the student body.

Publications Service

An extensive and important educational service is rendered by this College to the citizens of the Commonwealth through the distribution of published information. There are available for free distribution more than 400 informational bulletins covering in considerable detail the broad fields of agriculture, horticulture and home economics. Ninety-eight of these are publications of the Extension Service of the College, 62 are Experiment Station bulletins and 293 are publications of the United States Department of Agriculture.

Extension Service bulletins are published to support the educational program in agriculture and home economics carried on throughout the state by representatives of the College and the County Extension Services. As with all bulletins, they also are extensively distributed in response to direct requests for information.

Experiment Station publications are reports of research conducted at this Station. They are distributed to farmers in response to requests for information and also serve as a medium for exchange of information between workers in the vast program of agricultural research being carried on by experiment stations all over this country and in foreign lands.

Out of the tremendous library of bulletins published by the United States Department of Agriculture, 293 are kept available for distribution from this College since they deal with subjects of importance to this section. They are distributed in answer to requests for information and also are used in the educational program of the Extension Service.

During the year 1930, 163,000 of these informational bulletins were distributed to 37,000 people in response to their requests.

The College also published a monthly newspaper, "The Massachusetts Agricultural College Review" which is intended to report the news of the College together with the comment of members of the staff upon outstanding developments in the fields of education and agriculture. This publication is sent only to leaders in these fields in the number of one thousand copies each month.

Periodical publications of limited scope are also distributed by the College to persons particularly interested in the specific subjects which they cover. The Market Gardeners' Journal, Farm Economic Facts and a poultry bulletin are the more important of these.

In addition to these publications already mentioned the College publishes and distributes the series known as "The M. A. C. Bulletin." This series includes eight bulletins each year including the College Catalogue, the Annual Report, and announcements of the Summer School, High School Day, Commencement, Stockbridge School and the Graduate School. In most of these publications the object is to inform the people of the State of the educational facilities which are available for their use at this College.

The Tercentenary Exposition

This College was asked to participate in the Tercentenary Celebration of the founding of the Commonwealth by making an exhibit in common with other state departments at the Eastern States Exposition and at Boston. The faculty took a keen interest in this project and with the guidance of a special committee prepared and set up three separate exhibits which showed very well the service which this College renders to the cause of education. The first exhibition was made by the College alone on the campus and completely occupied the Drill Hall. Thirty-two departments of the College exhibited their work in a manner that was both interesting and pleasing. This exhibition was open from July 18 to August 2 and the estimated attendance was 3,000.

In collaboration with other departments of the Commonwealth the College made a small exhibit at the Eastern States Exposition at Springfield, September 14 to 20. On account of limited space no effort was made to show the details of departmental service here but merely to show the splendid facilities for education with which the College is provided and also the wide extent to which its services reach out over the Commonwealth. A panoramic painting of the campus twenty feet long exhibited the former and a sixteen foot map of the State upon which were spotted the various services of the College pointed out the latter.

At the exhibition at the Commonwealth Armory in Boston, September 30 to October 11, the College occupied a space sixty-five feet long, in which were exhibited the same features as at Springfield and in addition the detail services of the divisions of Agriculture, Horticulture, Home Economics, Physical and Biological Sciences and Social Sciences. It is estimated that nearly a half million people saw this exhibit and it should have had a large influence in bringing about a better understanding of the work of the College among the citizens of eastern Massachusetts.

An illustrated leaflet entitled, "Sixty-Three Years of Service to the Commonwealth" was published in conjunction with these exhibits. This leaflet summarizes the service which the College renders and includes a brief historical sketch. It is available for further distribution for informational uses.

Cost of this College to the Commonwealth

As a preliminary to the preparation of our annual budget estimates for the coming year, I have made a study of the receipts and expenditures of the institution for the past six years.

I submit below a summary of the results of this study showing the total of the legislative appropriations for the general maintenance expenses of the institution for the years 1925–1930, inclusive. Also, the receipts which have been collected by the institution and turned into the State Treasury during the same years and statement of the net cost to the Commonwealth on account of appropriations for general maintenance expenses of the institution. It will be understood, of course, that special items for permanent improvement at the institution are not included in this tabulation.

Year	Legislative Appropriation	College Receipts	Net Cost to Commonwealth
1925	$894,300 1,600		
	$895,900	$164,794 54	$731,105 46
1926	$896,200 1,150		
	$897,350	188,950 75	708,399 25
1927	$901,700 1,000 5,500 5,000		
	$913,200	223,455 24	689,744 76
1928	$946,860 5,000		
	$951,860	244,445 78	707,414 22
1929	$992,610 300 4,800		
	$997,710	271,850 19	725,859 81
1930	$1,027,000 4,950		
	$1,031,950	261,029 18	770,920 82

These figures show that despite the fact that during the period the new salary scale for State employees has been put into operation and the work of the Extension Service, the Experiment Station and the Control Service has been markedly increased, the net cost to the Commonwealth is now but little greater than it was at the beginning of the six year period. This fact is, of course, due to the very remarkable increase in receipts which have been collected and turned into the State Treasury. The increase in the latter is due in part to the establishment of a tuition charge for resident students and in part to the very large increase in fees collected for regulatory or control service; particularly in the Poultry Disease Elimination work.

Of course, the increase in fees is largely offset by the increased cost of operation of the Control Service but the latter is included in the total legislative appropriation so that the comparison seems to be a fair one in every way.

It seems to me that this statement shows a record for economy and efficiency in financial management of the institution by the Board of Trustees which is probably not equaled in any other educational institution of this kind in the country and, perhaps, not equaled in any other department of State in this Commonwealth.

PROBLEMS AND POLICIES

The Name and Scope of the College

In my inaugural address and in each of the three annual reports which I have presented to your Board since I became President of the College, I have alluded to the question of the name and scope of the College as one of the important problems with which its administrative officers are faced. I have stated successively some of the general phases of this problem; pointing out that from the viewpoint of the whole of the institution's activities in the fields of resident teaching, extension teaching, research and control service, the present name is not a misnomer, but that this name does not give a correct impression of the type and scope of the collegiate educational program which is now and for many years has been offered on the campus. I stated in my last annual report that I believed "that the fundamental question at issue is whether, in the future, the College shall be narrowly vocational or professional in the field of agriculture alone, or shall serve as the land-grant college in Massachusetts to provide for 'the liberal and practical education of the industrial classes for the several pursuits and professions of life,' as indicated by the original Act of Congress which provided for the establishment of these colleges." To this I might have added my belief that the name of the College should indicate as accurately as possible which of these two functions the institution is to serve.

On several occasions I have expressed my opinion that the appropriate time for final consideration and decision of these questions would be when the report is made public of the survey which has been made by the Bureau of Education of the United States Department of the Interior of the present development and probable future policies of these "land-grant colleges." That report is not yet available, although it is expected to appear in printed form in the very near future. In the meantime, however, certain events have occurred which lead me to believe that action should be taken on the question of the name of the College at once, in order to clarify in the minds of the public the place in the State's educational system which this institution now occupies and is to fill in the future. Additional expressions of sentiment and wishes concerning a possible change in name have been received from students. The Associate Alumni has conducted a formal canvass of its members which has indicated their general consensus of opinion concerning the matter. The more important event, however, is the initiative petition to the Legislature by a group of citizens, for the establishment of a "University of Massachusetts" at which many of the opportunities which are now offered at this College shall be provided elsewhere. This proposal indicates clearly the need for a better general knowledge of the facilities for collegiate education which are now provided by the Commonwealth at this College and seems to me to make it important that our own problem with reference to the name and scope of this College should be settled before any other similar enterprise is entered upon by the Commonwealth.

The Scope of the College

The original charter of the College, approved by the General Court in 1863, declared that "The leading object of the College shall be to teach subjects relating to agriculture and the mechanic arts, so as to promote liberal and practical education. Its curriculum may include other scientific and classical studies and shall include military tactics."

This statement of the scope of the collegiate teaching work of the College has remained unchanged from that time to the present. Subsequent Acts of Congress and the General Court of Massachusetts have added to the original function of teaching on the campus the other duties of the College; namely, experiment station research, regulatory and control service for enforcement of special laws, and agricultural extension teaching off the campus. But the original statement of purpose and objects of collegiate teaching has remained unchanged for more than half a century.

Under this charter, there have been developed excellent courses in various major subjects which have a direct application in farming operations and others which

prepare for various agricultural business. Prior to the World War these were all four-year courses entitling the student to the degree of Bachelor of Science upon their satisfactory completion. More recently, however, there was established the "Two-year Course in Practical Agriculture," now known as "Stockbridge School of Agriculture." This two-year course of intensive study of specific vocational subjects has now come to be recognized, not only here in Massachusetts but in many other states, as a more feasible method of training for general farm operations than is a four-year course leading to a degree, for which many non-vocational academic subjects are a necessary requirement. The latter have in themselves a great cultural and citizenship value and are a recognized part of every course in collegiate education leading to a bachelor's degree. But the shorter, more intensive, and more highly specific training of the vocational course is now coming to be very generally recognized as a most desirable post-high school training for many "industrial pursuits of life" including agriculture.

It may be said truthfully then that this College, throughout its entire history, has splendidly fulfilled its leading function of "teaching subjects related to agriculture."

But it has developed also splendid courses in "other scientific . . . studies." For thirty years or more, there have been opportunities at this College for major work in botany, chemistry, entomology, economics and sociology and landscape architecture which have been known the world-over as turning out men most excellently trained for scientific work in those several fields. More recently, the newer sciences, such as bacteriology and physiology and newer phases of agriculture and horticulture, as well as a collegiate course in home economics, have been provided. These have all been developed under the authority of the original charter as a legitimate part of the commission which it imposes upon the College "to promote liberal and practical education;" and in harmony with the development of the "land-grant colleges" in other states. It might be said, however, that many others of these colleges have gone much farther than has Massachusetts in developing courses of study in "classical subjects."

To change the program of the collegiate work of the College now in such a way as to make it narrowly professional or vocational in the field of agriculture alone would be a limiting of the original commission or charter of the institution in a way which the experience of the past fifty years cannot possibly justify and would impose a task upon the faculty and administrative officers which it would be impossible to carry out without wrecking the splendid structure which has been built up here and which has served the educational needs of the youth of the Commonwealth so well.

The Name of the College

The College has developed as I have indicated under its present name of "Massachusetts Agricultural College." The reason for the original adoption of that name is known to all those who are familiar with its early history, namely, in order that it might indicate clearly that the function of teaching "subjects related to mechanic arts," which in most of the states of the Union is assigned along with that of teaching "subjects related to agriculture" to the "land-grant college" in that state, is in Massachusetts not assigned to this College, but elsewhere, that is, to Massachusetts Institute of Technology.

Several times during the past, there have been more or less active agitations among students and friends of the College for a change in its name, in order that the name might more accurately represent the collegiate teaching which was in progress on the campus.

Many of the arguments against the present name, to the effect that it hampers opportunity for employment of alumni, keeps away students who would come to it if it had another name, limits the possibility of securing outstanding scientists and scholars for its faculty, etc., etc., are easily answered by the simple statement that the institution as it is (including its name) is what the Commonwealth of Massachusetts desires to offer in the field of state-supported collegiate education and anyone may come to it or not as he chooses, but if he does come he must accept its opportunities and limitations as the State's offering to him.

A much more serious argument against the present name is that, to those officials of the State who come into office without previous knowledge of the charter, functions, and history of the College and who as legislators vote upon financial and other matters affecting it or who administer state regulations which affect its routine transactions, the name of the College gives a wrong impression as to its proper scope and activities. As a result, the Trustees and President of the College are often suspected and sometimes openly accused of making requests for support which are out of proportion to the needs of the institution or of attempting to expand the institution beyond its properly authorized field or in excess of the needs and wishes of the Commonwealth. This situation has led to much embarrassment and serious difficulties in the administration of the College at various times in the past.

Moreover, in the past, there have been attempts by different groups of citizens to secure legislative action looking toward the offering by the Commonwealth of Massachusetts of additional opportunities for collegiate education, and these citizens have invariably expressed great surprise to learn that the State was already providing most of the desired opportunities at a college whose name indicated that it offered education in only one field.

However, the College has developed to its present splendid place in the esteem of every one who knows what excellent work it is doing without any change in its name, and it would seem that from the standpoint of its own welfare alone, it might easily continue to operate under the name with which it has made such progress and so excellent a reputation.

On the other hand, I am convinced that the time has come when for the sake of clarifying the position which the College occupies in the State's educational system and of remedying the confusion which exists in the minds of the public as to its aims, purposes, and duties, its name should be changed.

The petition which is to be presented to the General Court of 1931 for the establishment of a "University of Massachusetts," at which there may be offered many of the educational opportunities which are now available at our College and others which might be made available here at comparatively slight cost to the Commonwealth, indicates the need for a better understanding of our relationship to and place in the educational program of the State.

My belief is that no change in the charter or policies of the institution is needed in order to permit it to perform the functions which the Acts of Congress and of the General Court of Massachusetts have authorized and facilities for which wise and careful administration of the College in the past have developed. But I do believe that a change in the name of the institution is imperative in order that these functions and facilities may be properly understood and appreciated by the people of the State and by their elected representatives and administrative officials.

What the new name might best be is, of course, a question upon which there can be a variety of opinions. It would be out of place here to enter into an extended discussion of the advantages and disadvantages of each of the many possibilities.

It seems to me to be fairly clear, however, that the name which will most satisfactorily establish the proper position of this institution with reference to other educational activities of the Commonwealth and which, in my opinion, will serve best to clarify the situation that now exists and best prepare the way for continued successful service by the College to the Commonwealth, is "Massachusetts State College."

I therefore recommend that the necessary legal steps be taken, at the earliest possible moment, to change the name of the institution from "Massachusetts Agricultural College" to "Massachusetts State College." I believe that in taking such steps, no change should be made in the present charter, or legal statement of objectives of the College; and that it should be generally understood that no such change is contemplated unless some new situation with reference to the needs for state-supported collegiate education in Massachusetts should arise.

Progress in the Five-Year Building Program

Physical Education Building. — After several harrowing experiences following the collapse of the stock market last fall and several startling last minute changes in financial and structural plans, the funds became available for the physical education building complete in all its essential units as originally planned. Prompt action by everyone concerned resulted in the preparation of satisfactory plans by Morse and Dickinson as architects, and the advertising for bids and awarding the contract for the erection of the building to J. G. Roy and Sons of Springfield, in time so that actual excavation work began a few days before Commencement in June. The contract was awarded for approximately $226,000 for the building to be completed according to original specifications. This sum is considerably less than the original estimate of cost and has permitted the provision of numerous modifications and "extras" which have made the building much more attractive in appearance and more usable in operation than it would have been otherwise.

The extraordinarily favorable conditions of weather and of supplies of labor and materials this year have made possible almost unbelievable progress in the erection of the building. There is very active possibility that the building may be ready for use before the end of this college year, although the contract calls for completion August 1. Preliminary plans for dedication at next Commencement are under way. Already, noticeable effects upon general student morale from the presence on the campus of this long-desired addition to our equipment for student welfare are apparent.

Freshman Dormitories. — During the past summer, North College was completely remodelled on the interior and its rooms and those in South College furnished with new furniture and assigned for use exclusively by freshmen. One hundred freshman men and practically all of the freshman women are now housed in college dormitories, with splendid results as to the development of class spirit and college morale.

Library and Landscape Architecture Building. — Architects' preliminary plans for these two buildings have been prepared and estimated costs for them included as special items in the budget which has gone to state officials for consideration this fall. It is to be hoped that provision for these may be made among the appropriations to be granted by the General Court of 1931.

Administration Building. — Preliminary plans have been prepared for this building, these plans to serve as the basis for a specific request for an appropriation for its erection in the near future. The building is being planned to occupy a site to the south of Clark Hall, facing the south and standing at the entrance of the campus from the principal street from the center of Amherst.

Other additions to physical plant. — The horticultural manufactures building was completed and occupied during the year. An addition to Fisher Laboratory to provide better facilities for storage and packing of orchard fruits was also completed and used in handling the unusually large apple crop of the past season.

Minor improvements in walks, roads, and parking spaces have added to the appearance and utility of the campus, and additions to the water distributing system have increased the facilities for fire protection.

CONCLUSION

Altogether, it seems clear that this has been a year of splendid achievement, and I wish to congratulate you upon the progress which the College is making under your wise guidance, and to assure you that your sympathetic yet careful consideration of the recommendations which come to you from the faculty and President is most heartily appreciated by us.

Roscoe W. Thatcher,
President.

BUDGET FOR 1931

The following requests for appropriations for the support of this institution for the fiscal year beginning December 1, 1930, have been transmitted to the Commission on Administration and Finance for consideration in connection with the preparation of the state budget for the year.

General Maintenance

	Personal Service	Maintenance Expenses	Total
General College	$455,580	$114,285	$569,865
Experiment Station	92,507	20,000	112,507
Extension Service	68,170	42,200	110,370
Waltham Field Station	9,300	7,300	16,600
Short Courses	63,135	12,275	75,410
Heat, Light and Power	–	54,500	54,500
Physical Plant Expenses	26,000	39,000	65,000
Fertilizer Control Law	11,600	3,600	15,200
Poultry Disease Law	23,000	19,000	42,000
Milk Testing Law	600	800	1,400
Commercial Feeding Stuffs Law	9,000	2,000	11,000
Seed Control Law	3,900	1,400	5,300
Laboratory Service	5,250	750	6,000
Trustee Expenses	–	1,200	1,200
Printing Reports	–	1,500	1,500
Totals	$768,042	$319,810	$1,087,852
Emergency	–	–	5,000
Total request for maintenance	–	–	$1,092,852

Permanent Improvements

1. Library, Additions and Fireproofing, $175,000

As a result of a careful study of the library needs of the College by a special committee of the faculty it is pointed out that approximately twice the present floor space is needed. For example, at present the library conveniently accommodates only 70 readers whereas provision should be made for 150 on the present enrollment basis. No coat rooms or toilets are now provided. Book storage space is so deficient that the dirt floor basement and extra shelves to the ceilings have to be utilized and the availability of books to readers is greatly reduced. The present business office and work rooms are very inadequate.

In view of the fact that the contents of this building are estimated to be worth $500,000, much of which could not be replaced if destroyed by fire, it is very important that the present building and the new additions be made as fireproof as possible. The method for fireproofing the present building has been specifically recommended by State Fire Inspector, Ira C. Taylor.

2. Landscape Architecture Building, $98,000

Student enrollment in courses in Landscape Architecture has increased from 214 in 1922 to 358 in 1930. Present facilities are wholly inadequate and not only handicap the instruction in this subject but impose serious handicaps upon the instruction in Pomology with which department it shares class rooms and laboratories.

The solution of this problem which was suggested in the five-year building program called for the reconstruction and remodelling of the old wooden Stockbridge House at a cost of $36,000. Since this has been declared to be unwise as a state policy the project for a new building on the site of the Stockbridge House is substituted. The Stockbridge House is in such condition of disrepair that its demolition or reconstruction is imperative.

3. Renewal of Steam Mains, $15,000

The original steam mains on the campus are over 28 years old and they are eginning to give way in several places. In addition the steam main running to the 'hysical Education Building is not large enough to meet requirements. It will be ecessary therefore to replace this with an eight-inch main. The amount esti- ıated will provide these necessary repairs and replacements.

4. Road Reconstruction, $10,000

Main campus roads should be macadamized as soon as possible. One of the mportant main roads was rebuilt in 1929 and it is now proposed to continue this onstruction from the point where it stopped in 1929 to the main highway at the orth entrance to the campus, together with main connecting roads.

5. New Road, $5,500

It is proposed to build a new road of good gravel construction which will con- inue the present road to the President's house and the orchards south over the row of the hill and southwesterly to the main road. Not only will this greatly mprove the accessibility of the orchards and the President's house, but it will nake available five building lots which it is believed can be sold to members of the aculty at a sum more than sufficient to cover the cost of this construction.

6. Remodelling Drill Hall for use as Girls' Gymnasium, $6,000

The completion of the new Physical Education Building will make available the Drill Hall for use by girls as a gymnasium. This will meet a very urgent need vhich has been pressed by the Trustees of the College many times in the past. Some alterations will be necessary to make this building suitable.

7. Lumber Storage Shed, $2,500

The necessity for purchasing supplies in larger quantities than formerly in ac- ordance with the policy of the State Purchasing Bureau makes it necessary to provide larger storage facilities.

8. Installation of a Full Automatic Stoker for Steam Boiler, $3,000

There is only one boiler at the power plant that does not now have an automatic stoker and it is considered economy to provide this equipment.

REPORT OF THE DEAN

An unusually good year is a fair statement to make at the beginning of this eport. The marked diligence of the faculty, the splendid attitude of the student body together with the hard work and marked aggressiveness of the Administration ınd the generous support of the Trustees and the Legislature all made their needed contribution. The record of real accomplishments since President Thatcher came o the College is a source of inspiration to all who have a genuine interest in M. A. C.

If new departures are an indication of progress, then this may also be called ı year of progress. While the changes inaugurated are tremendously significant ınd have a definite effect upon the morale and attitude of the faculty, student body ınd general public, they are not in any sense revolutionary.

In several of my former reports I called attention to the need of Freshman dormitories. With the steady increase of our student body the problem of housing assumed a position which called for immediate action. Last year the Trustees recommended and the Legislature approved an appropriation of $30,000 for the purpose of remodelling North College. The work was started early in June and completed before College opened this September. In addition to the renovation of North College, all dormitory rooms in both North and South College were refurnished. Both dormitories were used exclusively for Freshmen and made possible the comfortable housing of 105 first year men.

This policy of Freshman dormitories gives us the opportunity of taking care o more than half of our new men students until they have had a chance to familiariz themselves with housing facilities in private homes and fraternities. It also en ables the students to get acquainted quickly and easily and affords the Administra tion ready access for purposes of direction and counsel — in a word it simplifies th problem of orientation.

The dormitories are in direct charge of a matron — Mrs. Nathaniel Hill — wh occupies a suite of rooms in the east entry of North College. She sees that th rooms are kept clean and in good order through a system of daily inspection.

The simple rules governing student conduct drawn up by a student-facult committee are enforced in the main by a student committee chosen by the occu pants of the rooms from their own number. The dormitory plan has raised th morale of the new students.

With the opening of the fall term a new schedule of hours went into effect whic is meeting with the general approval of both students and faculty.

This new schedule changes the first period from eight to eight-thirty o'cloc and permits the holding of morning chapels at eight o'clock instead of seven thirty-five as formerly. Because of this change practically all students, includin those who commute, can attend. The programs for these chapels are carefull planned and varied by the introduction of vocal and instrumental music, addresse by noted speakers, and group singing. This unifying exercise is meeting a rea need in this College where so large a percentage of the students live in privat homes off the campus.

The Wednesday afternoon assemblies have been reduced from a weekly to a monthly basis and the programs greatly strengthened. Attendance at chapel and assemblies is compulsory.

In an effort to impress upon the students early in the college year the attitud of the College toward scholarship, a "Scholarship Day" was instituted. The out standing event of this Day was the afternoon student assembly. All members o the teaching faculty in Academic costume attended this simple, but dignified an impressive exercise, in which an address by George Daniel Olds, President emeritu of Amherst College, was the main feature. An attractive program which listed all the prizes and honors offered on the basis of scholarship together with th names of the students who won them during the year, was presented to every student. The venture proved a distinct success and will be repeated next year.

The one term Honor course described in my report last year was given during the spring term by Professor A. A. Mackimmie and was elected by 10 students. In "Departmental Honors Work" discussed in my last year's report the following students were accepted by the Committee this year:

Walter R. Dangelmeyer in Agricultural Economics.
Albert H. Gower in Chemistry.
Paul A. Smith in Dairy Manufactures.
Evelyn A. Beaman and Frederick S. Troy in English.
Louis Pyenson, Frank R. Shaw, and Allen S. West, Jr., in Entomology.
John C. Lawrence and Paul B. FitzGerald in Landscape Architecture.

The freshman advisers who assisted the Dean and Assistant Dean in the important work of guiding and directing the new students this year were Professors Skinner, Julian, Serex, Goding, Mr. Boutelle, Mr. Briggs, and Mrs. Robertson. The splendid service of these advisers, all of whom carried rather full teaching schedules, is deserving of more than passing notice. Their efforts are appreciated.

For a number of years the College has had an arrangement with Cornell and Dartmouth Universities which makes it possible for students of high scholastic standing to enter the medical departments of these Universities at the end of their Junior year. Upon the completion of their first year in the Medical School they receive their Bachelor's degree from this College, provided their work merits the recommendation of the University. This enables a student to obtain with his Bachelor's degree credit for one year in Medicine. A similar arrangement for Forestry students was effected with the Yale Forestry School this year.

A simple yet very significant change in the freshman course of study was put ıto effect with the class of 1934. This requires students to declare their field of ıajor interest when they enter College. Those interested in Agriculture and Iorticulture substitute an Agricultural or Horticultural course for Modern Lanuage in the freshman year. Women students desiring to major in Home Ecoomics have an option between Mathematics and Modern Language and subtitute Home Economics for the subject dropped. In the class of 1934, 22 elected ıgriculture, 40 Horticulture, 22 Home Economics, 39 Social Science, and 100 'hysical and Biological Sciences.

The College curriculum was enriched by adding new courses in English, Hortiultural Manufactures, Physics, Mathematics, Home Economics, Agricultural Economics, Zoölogy, and Physical Education. Minor adjustments were made in xisting courses both in content and credit hours to conform with the changed equirements for graduation which reduced the required Junior-Senior credits from 20 to 108.

The schedule is now handled entirely in the Dean's Office. This facilitates the ork of registering students and checking their programs. The available office pace is not really adequate to house all the clerks, desks, files, and other equipıent needed to carry the work assigned to the Dean. Any material increase in he student body will make it necessary to secure additional room. It is, thereore, hoped that the new Administration building included in our five-year building ›rogram will be provided at an early date.

The problem of finding the best method for handling the student who fails to ıake a satisfactory scholarship record has received some consideration during the ear. For the past four years the percentage of freshmen dropped at the end of the irst term was surprisingly constant; from ten to twelve per cent. There is no uestion about their not being fitted for college work, but there is some question s to the best time in the college year for dismissing them. Further study may ›ring a more satisfactory solution.

We are also confronted with the question of finding a satisfactory entrance ırrangement for three types of students: (1) those with good scholastic records rom parochial schools not on the approved list of the New England College Enrance Board; (2) those who have been out of high or preparatory school for two ›r three years and who need to review certain courses before attempting college vork; and (3) those who failed to take the proper courses in High School, and ılthough their scholastic records were good cannot meet the requirements for ntrance. To make such students pass entrance examinations in all the subjects equired for entrance seems an unnecessary burden.

It is hoped that a satisfactory method may be drawn up and presented to the aculty for approval before the end of the year. The present arrangement is ntirely workable except for the types of students listed.

Wm. L. Machmer,
Dean.

REPORT OF THE DIRECTOR OF THE GRADUATE SCHOOL

At commencement, June 16, 1930, eighteen advanced degrees were conferred, of which fifteen were master of science and three doctor of philosophy. There was no significant variation in the total enrollment and, while more of the graduate students came from Massachusetts than heretofore, several other states and a few foreign countries were represented.

From these evidences alone it would appear that the activities of the Graduate School saw little change during the year, and in general this is the case. While the Institution, because of its organization, will always be limited in the field covered by its formal program of classroom instruction, it is nevertheless very adequately equipped for advanced study in most departments represented in its curriculum. Opportunities for graduate study are offered by nearly all of the departments in the divisions of agriculture, horticulture, social science, and physical-biological science.

The close relationship that has been developed between the Graduate School and the Experiment Station has had the encouraging effect of preventing the former from reaching a static condition in its development. The increased financial support recently made available to the Experiment Station from both State and Federal sources has made possible improvements in the facilities for research work in several additional departments. These improvements are naturally reflected in the organized classroom instruction, with the result that a high grade of graduate study is now possible in several departments which previously were not listed in the Graduate School. The advantages of this increased utility were fully recognized by the Administration so that, when Dr. H. T. Fernald retired from the directorship of the Graduate School in July, 1930, the Board of Trustees upon the recommendation of the President decided to place this unit and the Experiment Station under the same immediate administration.

During Dr. Fernald's very capable direction, which began after the death of his predecessor, Dr. C. E. Marshall, and continued for three years, the Graduate School made steady progress toward an increased scope and a more systematic organization so that today it holds a very enviable place among comparable institutions. It is the plan not only to continue this development, but also to capitalize more fully the increased opportunities for wholehearted co-operation made possible through this combination of the two units in the institutional organization devoted to research.

This arrangement also gives the graduate student the advantage of contact with and guidance from the research staff in the Experiment Station. Reciprocal benefits to the Experiment Station should accrue from the influence of student contact serving as a special incentive to the research staff to express results from investigations in a logical and therefore teachable form — so necessary before desired and worthwhile conclusions are possible.

There is one further advantage from this combination which, although secondary, is by no means insignificant. The Experiment Station receives from time to time funds from commercial agencies for the support of certain investigations in which they have a specific interest. Under ordinary circumstances this would be considered an extra service and one not always easily fitted into a well organized research program. Many of these funds do, however, lend themselves very readily to the support of fellowships whereby certain worthy students may obtain partial compensation for services for which graduate credit may be given. In other words, to illustrate, if the student's thesis subject is properly selected and the work is conducted under the guidance and scrutiny of a member of the regular research staff, it is possible to produce results of a quality that will satisfy the donors of the fellowship fund and also the graduate thesis requirements. There is every evidence that the demand for this type of service will increase and if projects are selected carefully the experiences of the past are adequate justification for its encouragement. At present there are seven different commercial agencies providing such financial support.

During the past three years, through a system of foreign exchange students, the Institution has been fortunate to have had on the campus three different German students, all of whom had received the degree of doctor of philosophy from some recognized German university. The presence of these students, in their close contact with others enrolled in the Institution, and especially in the Graduate School, has accomplished the purpose for which the service was organized. These students have furnished the means for a better understanding of the German people and their ideals and, incidentally, it is hoped that our students may have had a compensating influence on the exchange students. In all cases the individual who came to us left a very favorable impression and it is hoped that this relationship may be possible of continuance. Incidentally, all of the exchange students have been willing and able to conduct classes in the German language and thus many of our research workers who in their scientific investigations felt the handicap of unfamiliarity with foreign literature were afforded an opportunity for a definite type of desirable professional improvement.

As to limitations in the functions of the Graduate School, there are several.

While none of these are of a nature sufficiently serious to furnish a problem, they evertheless are worthy of earnest consideration. Of greatest significance is the emand for graduate work during the summer as part of the summer school course. Ve are receiving many urgent requests for graduate courses during the summer chool session from teachers in our public schools. While we realize our obligaions and see the value of such service and are well aware of the advantages resultng from this means of making closer contact with the public schools, the source of ur undergraduate students, we are nevertheless prevented from making a strong ppeal to those teachers because of certain arbitrary regulations in graduate degree equirements. Chief among these is the one pertaining to the selection of a satisactory minor. Since the offerings of graduate courses in the summer school are n themselves very limited and therefore provide the student with very little choice, t seems inconsiderate to insist strenuously upon the observance of certain other pecific regulations when such action has frequently resulted in discouraging worthy students whom the Institution should feel obligated to serve. To relieve his situation in large part it is hoped that arrangements may be perfected whereby 1) a minor may be offered in the department of languages and literature, and 2) those students preparing themselves for teaching and seeking an advanced legree may be offered either a greater choice of courses or special privileges in atisfying the graduate requirements.

F. J. Sievers,
Director of Graduate School.

REPORT OF THE DIRECTOR OF SHORT COURSES

Stockbridge Graduation

Ninety-one members of the senior class, including seven young ladies, were resented with diplomas on June 9, the last day of the eleventh annual commencenent exercises. Charles M. Gardner of Westfield, the editor of the National Grange Monthly, delivered a splendid commencement address on the obligation f the graduates to rural communities. With the graduation of the Class of 1930, nd beginning with the Class of 1920, the first graduating class, nearly eight hunlred students have received the diploma of the Stockbridge School of Agriculture, llustrating the significant work the College is carrying on in this non-degree, ocational department. This year's class is the largest ever graduated, excepting hat of 1923, as shown by the following tabulation:

Class	Number of Graduates	Class	Number of Graduates
1920	14	1927	70
1921	88	1928	59
1922	82	1929	89
1923	97	1930	92
1924	68		
1925	54	Total to date	787
1926	74		

At the time of this report our records indicate that at least seventy members of his latest class are definitely placed in agricultural or horticultural positions, lespite the difficulties which a poor year of business presented. They are filling such positions as gardeners, poultrymen, flower growers, orchardists, herdsmen, ow testers, assistants in dairy and ice cream plants, and several have established heir own businesses. One young lady who had completed three years at Vassar, previous to her work here, is in charge of a dairy herd in North Carolina. Another graduate is assistant county agent for the Farm Bureau at Mineola, Long Island, New York, and two other members of the class are dairy plant superintendents. As s the case every year, the largest group of students find positions in this state.

Fall Term Enrollment (Stockbridge)

By contrast with last year when registration was below normal, the present freshman class, numbering one hundred forty-seven, including eleven women students, is one of the largest classes ever registered. Three students from foreign countries, China, Albania, and Bolivia, are members of the group. Ninety-three students are registered in the senior class, or second year group, making a total for both classes of two hundred and forty. This figure is practically the same as in 1928, but represents a ten per cent increase over 1929. This fact is perhaps best explained by the usual tendency of young people to seek more training when jobs for unskilled labor are most scarce. Nearly all vocational schools have shown increased attendance this year.

Distribution of Students by Counties (Stockbridge)

In connection with the college exhibits held this year a map was prepared showing the geographic sources of the student body, segregated by counties. While nearly eight hundred students have graduated in the past eleven years, as earlier mentioned in this report, it is interesting to note from the following table that a total of more than twelve hundred students have been enrolled in the different courses for varying periods of time. It should not be interpreted that the scholastic mortality has been unusually high because of the difference in these two figures.

The apparently large variation between students registered and those graduated is explained by the heavy enrollment of ex-service men during the years 1919–1924 many of whom, because of physical disabilities, lack of scholastic preparation, and other factors, were unable to complete the full work for the diploma.

County	Number of Students	County	Number of Students
Middlesex	317	Franklin	56
Worcester	164	Bristol	49
Suffolk	149	Plymouth	39
Hampshire	137	Berkshire	34
Essex	94	Barnstable	19
Hampden	88	Nantucket	4
Norfolk	83	Dukes	3

Placement Service

More than the usual number of difficulties were encountered during the past summer in securing satisfactory placement positions for our men. Because of the large group registered in the major in Horticulture, over forty, many new positions had to be solicited, and in some few cases the only openings available were outside the state, chiefly in Connecticut.

Certain employers found it necessary late in the summer to reduce their forces, which resulted in some student lay-offs, with the placement supervisor unable to arrange for new positions due to the lateness of the season and slack business. Total earnings for the ninety-three Stockbridge men on placement during the six months' training period amounted to $42,180 for 1930.

In addition, the usual employment service to graduates was supplied by the placement office, although positions were not so plentiful as in other years.

Employment Service to Graduates

Applicants for positions	228
Positions available	173
Positions filled	113
Salaries or wages secured on basis of a year's employment	$145,711

The Winter School

Total registration for the 1930 Winter School was eighty-three, with fifty-eight students taking the ten week courses, and twenty-five enrolled for the ten day courses in dairying and ice cream manufacture.

The present organization of this work in definite programs of required classes seems to be well adapted to the needs of the students who are seeking training in these shorter and more intensive courses.

Enrollment by Courses

Greenkeeping Course	17
Florists' Course	17
Poultry Course	14
General Farming Course	10

Dairy Courses (Ten Days)

Testing and Milk Plant Operation	18
Ice Cream Making	11

In both the Greenkeeping and Florists' courses the maximum class enrollments for the facilities available were secured.

Summer School

Of the one hundred forty-eight students enrolled in the summer session, one hundred and seventeen were taking undergraduate courses and thirty-one were doing graduate work as members of the Graduate School. Exclusive of graduate students, the proportion of women students to men, was exactly two to one.

One hundred and twelve students were registered for courses in education which clearly emphasizes why the summer program must continue to include courses suited to the needs of the teacher.

ROLAND H. VERBECK,
Director of Short Courses.

REPORT OF THE LIBRARIAN

The Library now contains 87,916 books regularly catalogued, probably over 50,000 pamphlets so arranged as to be readily found, and some thousands of books awaiting cataloguing. During the year 3,436 books have been catalogued, and 220 discarded, making a net gain of 3,216 probably the largest year's growth in the history of the Library. The number of department libraries is now forty-four, as the Military Department has transferred its literature to the main library to render it more accessible to students.

By means of half of the time of the new assistant just granted, a good start has been made in cataloguing books which have waited for years for this care.

The building has been open for reading and borrowing of books three hundred and thirty-nine days during the year, and during the academic year has been open fourteen hours a day, and five hours on Sundays. There have been loaned for use outside the building 10,414 volumes, exclusive of reserved books loaned for overnight use only. The months of largest circulation have been January, 1,384 volumes; April, 1,457; May, 1,251; and November, 1,235. A slight change in the charging system has made it more accurate, by bringing to the attention of borrowers their responsibility in the transaction.

Over five hundred periodicals, and many other serials, are received and kept filed ready for instant consultation.

The year has been one of steady growth and revision, with a view particularly of the needed and hoped-for enlargement of the building. The representative library committee continues to function efficiently and render notable aid. A readjustment of financial bookkeeping methods has greatly relieved difficulty in handling the funds, by separating those assigned to the care of the Librarian from

those of other departments. The system of apportioning expenditures for periodi cals to the departments interested, inaugurated last year, continues to prove ver advantageous.

The granting of the new assistant has given hope of cleaning up some of th monumental tasks which have waited years for attention, and a good start ha already been made on several of these, such as the diagnosing, for cataloguing o discarding, of the many uncatalogued books in the building, with the aid of th heads of departments interested in each class of literature. The friendly co-opera tion shown in this tedious task has been very heartening. A steady pruning o the great pamphlet collection is being conducted, to render the material retaine more accessible, to save labor in future, and to eliminate dead wood and thu reduce cost in moving and temporary housing.

Active work has been done in planning for the enlargement of the building an strong hope is entertained of soon having the additional space for readers and fo storage of books which has been so long and so urgently needed.

B. B. Wood,
Librarian.

REPORT OF THE DIRECTOR OF THE EXTENSION SERVICE

The year 1930 has emphasized again the difficulties of the extension staff i meeting the increasing requests and opportunities to be of service. Considerabl improvement, however, has been noted by the specialists in their third yearl reports of progress toward goals set in their five-year plan of work. During th year state and county extension workers have assisted approximately 285,00 people through meetings, demonstrations, office and telephone calls, and farm visits. This work has been made possible only through friendly co-operation wit the resident and experiment station staffs of the college, the federal government, th state departments, 29 state-wide organizations, and many local groups.

In order to do their work effectively, several members of the state and county staffs took professional improvement work during the summer months. The county extension group proposed a plan for a leave of five months for professiona improvement for their members who have completed five or more years of extensio work in one county. The proposal was adopted by the college trustees in January 1930, and by eight of the county boards of agriculture since that date. Until th time is at hand when the vacancy in the county can be filled by a state worker, i will be necessary for the person taking professional improvement to plan his wor well in advance with the county and state administrations, so that it may b carried on with minimum personal supervision.

During the past year, approximately 550 news items and special stories hav been sent to the daily, weekly, and monthly newspapers and periodicals of th state, by the college news service under the direction of the extension editor. Thi is a slight increase over 1929. The M. A. C. Review, the college house organ, has shown considerable improvement in its quality and variety of material printed. There has been a slight increase in the number of extension leaflets printed during the year. In 1929, 22 were revised and 2 new ones printed. This past year, 2 were revised and 7 new ones, including 5 for the junior extension department, were printed. The 4-H news writing contest was continued with about 325 members enrolled.

The mailing and duplicating departments have been unusually active during the past year. A total of 37,026 requests for publications has been filled by sending 113,698 extension leaflets, 32,018 experiment station bulletins, and 17,870 U. S. D. A. farmers' bulletins. The mimeograph department completed 1,417 jobs, representing 2,359,052 copies, and the multigraph department, 364 jobs, representing 877,278 copies.

Farm and Home Week attracts the largest attendance of any of the meetings held on the campus under our supervision. There has been a steady growth in the number attending these meetings during the past five years, and last year's attendance was estimated at 3,600. Correspondence courses are conducted for those desiring them, the poultry and floriculture ones being the most popular. The

M. A. C. Radio Forum has been conducted weekly, and through the co-operation of various agencies our specialists have done considerable broadcasting.

From one to nine of the 19 unit exhibits prepared by the college were shown at 18 fairs and expositions by the county extension services. The largest undertaking was the one shown in connection with Massachusetts Governmental Exhibit at Eastern States Exposition and Boston.

An average of 300 copies per month of Program Hints, which contain educational, inspirational, and recreational material, has been received by program committees of community organizations in 196 towns.

Again this year the changes of the personnel in the extension service have been few. One member of the state staff has been transferred to the experiment station, and the vacancy of extension horticulturalist has not been filled. Due to the addition of new federal co-operative funds, an assistant specialist in agricultural economics has been added to the staff and a new assistant specialist in home economics will join the staff on February 1. Due to seven resignations, one professional improvement, and two new positions, ten new people have been added to the county staffs during the past year.

Agriculture

Economic information, properly used, has played an important part in the extension activities for several years. This year, which will be remembered for its abundance of crops in Massachusetts, farmers were assisted to find markets outside the local and usual channels of trade. Many carloads of potatoes and apples have thus been marketed that might otherwise have been wasted.

Under the direction of the federal rodent specialist, complete organization of many of our county extension staffs and their town representatives has been effected to distribute, from central points, poison baits to rid the homes and farm buildings of rats. The rat campaigns have been a tremendous success, not only in eliminating rats, but in teaching all branches of the extension service to coordinate their efforts for a common end.

Through the co-operation of the National Livestock and Meat Board, the meat packers, and the college and county extension services, two educational campaigns on the subject of lamb and beef cutting were conducted in the state. During the campaigns, one radio talk, five store demonstrations, and 64 meetings were held in 25 cities with an attendance 9,272.

Agricultural Economics and Farm Management

Work on assembling and interpreting basic economic information required in the formulation of state, county, and local programs for the improvement of agriculture has continued throughout the year. Market garden programs based upon the study of 312 records gathered on 18 crops of last year have been started in three counties. Some progress has been made in assembling material on the economic aspects of the Massachusetts apple industry. With the addition of another specialist, work has begun in collecting and assembling data which will help in the formation of county and local poultry programs. Again this year, the owners of 100 flocks of poultry have sent in their business records, in order to help determine the various factors influencing profits.

Agricultural outlook material and current crop and market information have been distributed through 10,000 copies of the New England Outlook Report, 850 copies monthly of Farm Economic Facts, monthly radio talks on developments in the New England agricultural situation, meetings, and miscellaneous news articles. Two groups were assisted in the organization of local co-operative marketing associations, which operated successfully in their first year.

Agronomy

As the result of the initial establishment of about 80 farm pasture plot demonstrations in 1929, together with two seasons of meetings, more than 2,000 acres of grazing land have been improved this past season. The most gratifying results

have been the widespread satisfaction expressed by the farmers themselves, since the grazing crop is the richest milk producing feed and the cheapest to grow and harvest of any now being grown. The system of crop management is becoming of premier importance as a feed crop for the dairy farm industry of the state.

The raising of 596 bushels of potatoes on a measured acre of land beat the 1929 record, by 141 bushels, in the 300 Bushel Potato Club. This past season 26 persons enrolled in the club raised more than 300 bushels to the acre, and 16 of these raised more than 400 bushels.

Animal Husbandry

The control and eradication of infectious abortion in cattle were discussed at 29 meetings of dairy farmers held in ten counties with a total attendance of 650. This program was supported by recent regulations from the State Division of Animal Industry, which assists farmers to eliminate the disease from their herds. The extension service and a substantial group of dairy cattle breeders of the state have developed a Proved Sire program for the identification of outstanding dairy herd sires.

Forestry

Demonstrations of weeding and thinning have been established on main highways in three counties. These are properly labelled and have brought a number of inquiries relative to these practices. Meetings have been held to discuss the subject of management with woodlot owners, and considerable interest is being aroused in securing an income from the woodlot at the same time the stand is being improved.

Market Gardening and Floriculture

More than 50 plant houses for growing early vegetable plants were built by market gardeners in various parts of the state, from a demonstration model erected at the Waltham Field Station. Considerable progress has been made in the improvement of certain strains and varieties of vegetables and in devising ways of having commercial seed stock of these grown for farmers. Close co-operation has been maintained with the Boston Market Gardeners' Association.

Those in charge of the research in floriculture at the Waltham Field Station have been quite actively engaged in extension work among florists, nurserymen, and home gardeners. A county-wide home grounds improvement project was conducted in one county.

Plant Pathology

Timely spray information was furnished apple growers in 12 counties, by the county agents through circular letters, telephone messages, and radio broadcasts. A check-up at harvest time indicated that apple scab was controlled generally where spray recommendations were followed. The time of spraying, especially in regard to rainfall, appears more important than the number of applications in preventing scab infection. In order to determine other phases of work in connection with the plant disease project, a survey was conducted in 11 counties.

Pomology

Believing that effective marketing necessitates, first of all, the production of a good product, this project has centered its attention on the matter of pest control and a reduction of the amount of blemished fruit. A feature of the program was the 90% Clean Apple Club. More than 300 commercial growers enrolled last spring in this effort to produce a commercial crop with not more than 10% of the fruit blemished by pests. Fifty-seven growers met the requirements of the club, compared with 15 in 1929. Ten badly infested orchards, over the state, were selected for demonstrations on the control of apple maggot. The results of the control measures recommended have been strikingly successful.

Poultry

The four major items of a longtime program for the development of the poultry industry in the state are disease control, stock improvement, economic production, and marketing. Disease control has been discussed at 25 meetings with an attendance of 1,163. Stock improvement and better breeding have been further stimulated at 14 meetings with an attendance of 1,168. Economic management has been promoted by such things as the increase in the size of flocks, the use of lights on the laying flock, and brooding of chickens. Improvement in marketing of Massachusetts grown turkeys has made progress as a result of the setting of grades.

Storage

A survey of the common storage facilities on farms of the state was made, with 850 growers expressing interest in the project. As a result, 110 were of sufficient importance to call for a visit. Seventy of these requests materialized into definite help in creating new storage equipment. Refrigerated storage on the farm developed rapidly this past year. Six orchardists provided themselves with storage of this type, either by new construction or by refrigerating already existing storages. These installations are being studied with a view of accumulating evidence for future use.

Home Economics

A much larger percentage of mothers of young children has been interested in all phases of the work; the foundation for a longtime, well balanced program is being laid in each county; more helpful information relative to the expenditure of the family income has been included; four studies have been made in order to get facts upon which to build the program; and there has been closer co-operation with the state, county, and local organizations.

All the county home agents co-operated with two sub-committees of the White House Conference committee in gathering data relative to the health, education, and protection of the pre-school child.

The home economics program has been carried in practically every town in the state. During the past year, 2,834 volunteer leaders have attended training conferences and have carried information to 14,107 homemakers. In the combined programs of specialists, home demonstration agents, and leaders, 51,994 have received information relative to their homemaking problems. Five thousand six hundred mothers of young children have been helped through timely information mailed to them monthly.

In addition to the projects reported below, a county-wide home ground improvement project was conducted in one county with an active part being taken by 918 persons. Several other counties have conducted series of meetings on the subject. The food preservation work has been conducted as usual by the lecture-demonstration method. In one county, three leader training meetings were held in the project with representatives present from 11 communities. Nine of these communities ended the project with an exhibit at a local fair.

Child Development and Parent Education

For the past year the child development project has been conducted formally throughout the state. The first objective was to acquaint the home demonstration agents and the women with the contents and purpose of such a project. This was accomplished through single meetings, publicity, communication, and carrying a series of five meetings to one or more groups in each county. A further objective was to lay a foundation for spread of influence. This was accomplished by having some of the study groups composed of representative women from many communities, who in turn could later interpret and help carry on the project in their communities. Twenty-four study groups were conducted, composed of 500 women and a few men representing 80 communities. Leader groups have been established in three counties and detail plans are under way for two others. As a special service, the specialist assisted with the resident course in child development that was offered to senior girls here at the college.

Clothing

More homes and mothers of young children have been reached by the development of new projects in children's clothing construction and selection. Two counties have carried the project on a county-wide leader training basis, three other counties have held leader groups, and 5,000 letters have been sent to a selected list of young mothers. The clothing projects have been taught directly to 6,492 women who in turn have passed on information to 3,896 others. This has been accomplished partially by the holding of 271 study courses and 49 all day meetings on renovation of the wardrobe and bringing it up to date.

Home Management

Some phase of the home management program has been carried in every county with special emphasis placed upon better kitchens and home furnishings. The number of communities reached, the number of women enrolled, and the results obtained in all phases of the project exceed those of former years. A continued effort has been made to put more of the work on a leader basis in order to develop leadership among those with whom the project is carried and to reach more community groups. The better kitchen project was carried on a leader basis in six counties with 102 teaching leaders and an enrollment of 1,277 women. In addition to this, 25 single meetings were held with an attendance of 2,397. The home furnishing project was carried on a leader basis in four counties with 108 leaders and 1,147 women enrolled, also 295 women were in community groups.

Nutrition

Most of the nutrition work was conducted on the leader basis, although the agents did carry a number of groups in new and isolated communities. Five thousand and eighty women were reached in organized project work, representing 6,457 children. Two hundred and fourteen leaders conducted 504 community groups. Our biggest progress has been made in reaching more mothers of young children and in making nutrition principles simple, desirable, and applicable to every day problems. During the past year, a monthly letter with a distribution of between 5,000 and 6,000 copies has been prepared by the specialist and sent to a list of mothers by the county home demonstration agents.

4-H Club Work

A picture taken at Eastern States Exposition in 1919 showed that in that year the girls enrolled in the clothing club made 1,978 garments. This past year they made 10,226. The same picture shows that there were bread clubs but no food clubs; this past year the food club members served 14,967 meals.

During the past year a steady growth in the enrollment and percentage of completion in the various projects has been noted. Special effort has been placed upon the training of local leaders. This has resulted in more meetings and a study made of the size unit which can be brought together at one place. The bringing to Camp Gilbert of 12 older club members for training in junior leadership proved so successful that it resulted in a larger school being planned for two weeks intensive training in 1931. Music appreciation and health work occupied a larger place in our program for 1930. Eight hundred and eighty-six boys and girls participated in the former, and 11 counties entered contestants in a state-wide 4-H health contest.

Boys' Club Work

The majority of the 4-H club boys enroll in the poultry, garden, dairy, or handicraft projects. The poultry club members figure that they have made approximately a net profit of $30,000 on their birds during the past 12 months. The team representing Massachusetts in the ninth national 4-H poultry judging contest at New York in January won the contest, bringing home with them seven out of twelve cups and two scholarships amounting to $75. The garden club project has broadened out to include flower raising. In two counties, interest is so keen that

garden club meetings are to be held during the winter. In two other counties, a combined vegetable garden and canning project was undertaken with a marked degree of success. The dairy club project has developed to a point where a car of animals was sent to the National Dairy Show at St. Louis; the animals won five prizes. The Massachusetts 4-H dairy demonstration team placed 8th, and the judging team 19th, with 27 states competing. Much emphasis has been placed on milk production records and many boys are finding out the value of some of their cows. The handicraft project had an enrollment of about 2,000 members. Slow but steady progress is noted in the 4-H forestry, baby beef, rabbit, and fruit projects.

Girls' Club Work

4-H club girls are interested primarily in the clothing, home decoration, room improvement, food, and canning clubs. An effort has been made to reach new communities with these clubs with the result that clothing work was organized in 87 new communities and food work in 38 during the past year. This has necessitated more help being given to the local leaders. About 48% of the local leaders of girls clubs are homemakers, 37% teachers, and 15% older club members. The home decoration project was new this past year, yet 91% of the 525 members completed the project requirements and made 2,235 useful articles for their homes. There has been a steady increase in the enrollment in the dress contest. In 1928 only 105 girls competed, and during the past year 529 from ten counties competed. The winner represented Massachusetts in the National 4-H Revue in Chicago. The food club members have served 14,967 meals at home and 322 community meals. There has been an increase in the number and improvement in the quality of the canned products exhibited by club members at the local fairs. One canning club competing at the National 4-H Club Congress in Chicago won a first prize of $100.

Willard A. Munson,
Director of Extension Service.

REPORT OF THE TREASURER

There is submitted herewith the annual report of the Treasurer for the fiscal year ending November 30, 1930.

The total income of the College from all sources, including the State and Federal appropriations, amounted to $2,051,967.56. We expended $1,746,934.84, leaving a balance of $305,032.72. A complete analysis of these figures is given below:

	State	Federal	Total Appropriation	Expenditures	Balance
College	$647,719 87	$70,679 18	$718,399 05	$672,955 97	$45,443 08
Experiment Station	105,087 38	101,390 38	206,477 76	197,228 77	9,248 99
Extension Service	105,501 07	75,166 70	180,667 77	159,535 33	21,132 44
Short Courses	71,190 51	–	71,190 51	71,617 14	—426 63
Waltham Field Station	15,201 75	–	15,201 75	15,181 08	20 67
Control Laws	74,929 11	–	74,929 11	73,945 49	983 62
Trustees' Travel	1,200 00	–	1,200 00	795 34	404 66
Printing Reports	2,277 05	–	2,277 05	1,137 42	1,139 63
Replacements	20,119 00	–	20,119 00	21,372 16	—1,253 16
Special Building Projects	418,345 19	–	418,345 19	265,563 20	152,781 99
Totals	$1,461,570 93	$247,236 26	$1,708,807 19	$1,479,331 90	$229,475 29
Trust Funds					
Student Loans	–	–	13,843 63	8,316 50	5,527 13
Endowments	–	–	23,889 95	7,106 15	16,783 80
Other Funds	–	–	305,426 79	252,180 29	53,246 50
Totals	–	–	$2,051,967 56	$1,746,934 84	$305,032 72

The College maintenance appropriation of State funds for current expenses for the year was $1,027,000. There was brought forward from the last fiscal year $16,225.74 with which to pay bills incurred in the previous year, making the total available for the year $1,043,225.74. The expenditures for the College were $1,020,-520.38, leaving an unexpended balance of $22,705.36. This balance will pay for the fuel necessary to carry the College to April 1, 1931, and such other bills as were

incurred but not paid for previous to November 30, 1930. These outstanding accounts are as follows:

College bills	$5,801 10
Fuel account	10,556 00
Experiment Station	29 59
Extension Service	113 60
	$16,500 29

This leaves a net balance of $6,205.07 that reverts to the State.

The special building appropriation made by the Legislature for the year 1930 was $222,700.00, and there was an additional item of $378.90 as a deficiency appropriation for macadam roads. In addition to this amount of $223,078.90, the Alumni and friends of the College contributed $115,000.00 towards the Physical Education Building and the State appropriated $172,500.00, making the total available for this building $287,500.00. There was a balance of $80,266.29 brought forward which makes the total amount available $418,345.19. Expenditures during the year amounted to $265,563.20, leaving a balance of $152,781.99 to be expended during 1931. Following is a statement of the special appropriations:

	Appropriation	Expenditures	Balance
1929 Building for Horticultural Manufactures	$54,755 78	$54,484 61	$271 17
1929 Emergency Needs	2,616 70	2,178 40	438 30
1929 Abattoir for Animal Husbandry	5,304 73	4,699 56	605 17
1929 Renovation Dairy Laboratory	4,000 00	3,721 03	278 97
1929 Garage Construction	127 13	88 76	38 37
1929 Roads Construction	37 51	37 51	–
1929 Poultry House and Hot Water Brooder	645 78	632 30	13 48
1929 Renovation Brooks Farm Barn	238 19	135 47	102 72
1929 Greenhouse M. G. F. Station	12,540 47	12,445 40	95 07
1930 Emergency Needs	5,000 00	3,502 16	1,497 84
1930 Platform Scales	2,200 00	2,004 11	195 89
1930 Building for Physical Education	287,500 00	144,205 01	143,294 99
1930 Remodeling North College	30,000 00	29,232 16	767 84
1930 Addition Fisher Laboratory	8,000 00	6,973 41	1,026 59
1930 New Water Main	5,000 00	844 41	4,155 59
1930 Road Construction	378 90	378 90	–
Totals	$418,345 19	$265,563 20	$152,781 99

The receipts of the Institution for the year were $261,029.18, a deficit of $10,821.01 over the previous year. This shortage occurs largely in the Experiment Station, College, and Control Laws.

The inventory for the Institution shows a value of $2,998,657.60, an increase of $180,926.77 over the preceding year.

Our trust fund accounts were increased $1,175.00 by the gift of Dr. Joel E. Goldthwaite, an alumnus of the College in the class of 1885, given in honor of his son, Vincent Goldthwaite, who died in 1922. This fund is to be used as a loan fund for students of the Stockbridge School of Agriculture, as well as those students in the regular four year course. These funds now amount to $139,061.85.

The examination of the accounts of the Institution for the fiscal year ending November 30, 1929, was made under the direction of the State Auditor. Our trust fund accounts were audited by the Trustee auditor, Mr. Frank Gerrett.

A complete detail of all receipts and expenditures follows.

Fred C. Kenney,
Treasurer.

STATISTICAL REPORT OF THE TREASURER

For the Fiscal Year ending November 30, 1930

Balance Sheet

		Debit	Credit
1929			
Dec. 1.	To balance on hand	$47,375 25	
1930			
Nov. 30.	To departmental income	261,029 18	
Nov. 30.	To receipts from State Treasurer	829,053 39	
Nov. 30.	To receipts from United States Treasurer	192,909 59	
Nov. 30.	To bills paid by State Treasurer	465,180 52	
Nov. 30.	Refunds transferred to State Treasurer		$1,198 91
Nov. 30.	Expenditures for fiscal year		1,479,331 90
Nov. 30.	Income transferred to State Treasurer		261,029 18
Nov. 30.	Balance on hand		53,987 94
		$1,795,547 93	$1,795,547 93

Statement of Legislative Apportionment and Expenditures for Fiscal Year ending November 30, 1930, and Apportionment requested for 1931

	Apportionment for Last Fiscal Year		Expenditures		Requested Apportionment for New Fiscal Year	
College:						
Personal Service	$456,000 00		$457,219 80		$478,580 00	
Maintenance	190,719 87		168,876 42		185,785 00	
		$646,719 87		$626,096 22		$664,365 00
Replacements	$21,119 00	21,119 00	$21,372 16	21,372 16	$25,000 00	25,000 00
Experiment Station:						
Personal Service	$85,500 00		$83,336 12		$92,507 00	
Maintenance	19,587 38		21,721 75		20,000 00	
		105,087 38		105,057 87		112,507 00
Extension Service:						
Personal Service	$66,000 00		$65,899 79		$68,170 00	
Maintenance	39,501 07		39,417 87		42,200 00	
		105,501 07		105,317 66		110,370 00
Short Courses:						
Personal Service	$60,045 60		$60,988 59		$63,135 00	
Maintenance	11,144 91		10,628 55		12,275 00	
		71,190 51		71,617 14		75,410 00
Waltham Field Station:						
Personal Service	$8,600 00		$8,619 48		$9,300 00	
Maintenance	6,601 75		6,561 60		7,300 00	
		15,201 75		15,181 08		16,600 00
Trustees' Travel	$1,200 00		$795 34		$1,200 00	
Printing Reports	2,277 05		1,137 42		1,500 00	
		3,477 05		1,932 76		2,700 00
Feed Law	11,036 95		10,663 35		11,000 00	
Fertilizer Law	14,100 00		14,610 00		15,200 00	
Milk Testing Law	1,400 00		1,369 04		1,400 00	
Poultry Disease Law	37,500 00		36,730 97		42,000 00	
Seed Control Law	5,392 16		5,073 47		5,300 00	
Laboratory Service	5,500 00		5,498 66		6,000 00	
		74,929 11		73,945 49		80,900 00
Totals		$1,043,225 74		$1,020,520 38		$1,087,852 00
Balance unexpended				22,705 36		
				$1,043,225 74		

Cash Statement

	Other Funds	State Funds	Totals
Balance December 1, 1929	$47,375 25	–	$47,375 25
Receipts			
College receipts from students and others	–	–	73,201 68
Tuition	–	$39,720 00	–
Laboratory fees	–	6,798 13	–
Rent	–	22,536 70	–
Other charges to students	–	4,146 85	–
Department Sales	–	–	71,205 47
Products	–	61,868 92	–
Miscellaneous	–	9,336 55	–
Experiment Station	–	–	17,293 60
Chemistry	–	296 88	–
Cranberry	–	6,668 14	–
Pomology	–	2,113 92	–
Poultry	–	5,804 89	–
Station Service	–	2,409 77	–
Extension Service	–	–	769 56
Correspondence	–	494 45	–
Miscellaneous	–	275 11	–
Short Courses	–	–	17,875 75
Student fees	–	16,884 75	–
Winter School	–	991 00	–
Waltham Field Station	–	–	282 25
Produce	–	282 25	–
Feed Law	–	22,034 42	22,034 42
Fertilizer Law	–	16,520 49	16,520 49
Milk Testing Law	–	1,103 55	1,103 55
Poultry Disease Law	–	39,407 38	39,407 38
Seed Control Law	–	295 90	295 90
Laboratory Service	–	–	1,039 13
Bacteriology	–	698 13	–
Pathology	–	341 00	–
Treasurer of the Commonwealth	–	–	829,053 39
Maintenance	–	803,327 96	–
Special appropriations	–	18,774 01	–
Endowment	4,821 42	–	–
Smith-Hughes Fund	2,130 00	–	–
Federal Government	–	–	192,909 59
Land Grant of 1862	7,300 00	–	–
Hatch Fund of 1887	15,000 00	–	–
Morrill Fund of 1890	16,666 67	–	–
Adams Fund of 1906	15,000 00	–	–
Nelson Fund of 1907	16,666 66	–	–
Smith Lever Fund of 1914	32,316 26	–	–
Purnell Fund of 1925	60,000 00	–	–
Capper Ketchum Fund of 1928	21,960 00	–	–
Additional Federal Co-operative Fund	8,000 00	–	–
Bills paid by State Treasurer	–	465,180 52	465,180 52
	$247,236 26	$1,548,311 67	$1,795,547 93

Payments	Other Funds	State Funds	Totals
College Expenses	–	–	$672,955 97
Personal Services	$46,859 75	$457,219 80	–
Maintenance	–	168,876 42	–
Replacements	–	21,372 16	21,372 16

	Other Funds	State Funds	Totals
Experiment Station	–	–	$197,228 77
Personal Service	$82,544 59	$83,336 12	–
Maintenance	9,626 31	21,721 75	–
Extension Service	–	–	159,535 33
Personal Service	53,648 65	65,899 79	–
Maintenance	569 02	39,417 87	–
Short Courses	–	–	71,617 14
Personal Service	–	60,988 59	–
Maintenance	–	10,628 55	–
Waltham Field Station	–	–	15,181 08
Personal Service	–	8,619 48	–
Maintenance	–	6,561 60	–
Trustees' Travel	–	795 34	795 34
Printing Reports	–	1,137 42	1,137 42
Feed Law	–	10,663 35	10,663 35
Fertilizer Law	–	14,610 00	14,610 00
Milk Testing Law	–	1,369 04	1,369 04
Poultry Disease Law	–	36,730 97	36,730 97
Seed Control Law	–	5,073 47	5,073 47
Laboratory Service	–	–	5,498 66
Bacteriology	–	2,751 19	–
Pathology	–	2,747 47	–
Special Appropriations	–	–	265,563 20
1929 Building for Horticultural Manufactures	–	54,484 61	–
1929 Emergency Needs	–	2,178 40	–
1929 Abattoir for Animal Husbandry	–	4,699 56	–
1929 Renovation Dairy Laboratory	–	3,721 03	–
1929 Garage Construction	–	88 76	–
1929 Roads Construction	–	37 51	–
1929 Poultry House and Hot Water Brooder	–	632 30	–
1929 Renovation Brooks Farm Barn	–	135 47	–
1929 Greenhouses Market Garden Field Station	–	12,445 40	–
1930 Emergency Needs	–	3,502 16	–
1930 Platform Scales	–	2,004 11	–
1930 Building for Physical Education	–	144,205 01	–
1930 Renovation North College	–	29,232 16	–
1930 Addition Fisher Laboratory	–	6,973 41	–
1930 New Water Main	–	844 41	–
1930 Road Construction	–	378 90	–
Income	–	261,029 18	261,029 18
Refunds to State Treasurer	–	1,198 91	1,198 91
Balance	53,987 94	–	53,987 94
	$247,236 26	$1,548,311 67	$1,795,547 93

Budget Appropriation for Current Expenses for Year ending November 30, 1930

Personal Services:	Appropriation	Current Year	Balances
Administration	$37,000 00	$37,105 61	—$105 61
Instruction	236,000 00	232,457 39	3,542 61
Maintenance:			
Departmental	60,000 00	66,451 57	—6,451 57
Farm	34,000 00	35,391 53	—1,391 53
Operating	68,000 00	61,468 63	6,531 37

Personal Services — *Concluded*	Appropriation	Current Year	Balances
Repairs Ordinary	$21,000 00	$24,345 07	—$3,345 07
Replacements	1,000 00	1,574 28	—574 28
Experiment Station	85,500 00	83,336 12	2,163 88
Fertilizer Control Law	10,500 00	10,954 90	—454 90
Poultry Disease Law	21,500 00	21,611 22	—111 22
Dairy Law	600 00	484 50	115 50
Feed Control Law	9,000 00	8,489 69	510 31
Seed Control Law	3,900 00	3,354 80	545 20
Laboratory Service	4,900 00	5,010 22	—110 22
Extension Service	66,000 00	65,899 79	100 21
Waltham Field Station	8,600 00	8,619 48	—19 48
Short Courses	60,045 60	60,988 59	—942 99
Total Personal Services	$727,545 60	$727,543 39	$2 21
Travel	$6,000 00	$5,966 07	$33 93
Office and other Expenses	37,874 98	28,931 23	8,943 75
Teaching and Laboratory Supplies	56,284 79	57,291 33	—1,006 54
Minor Equipment	7,924 16	9,160 48	—1,236 32
Experiment Station:			
Supplies and Equipment	14,559 57	17,717 35	—3,157 78
Travel	3,500 00	2,735 59	764 41
Office Expenses	1,527 81	1,268 81	259 00
Extension Service:			
Supplies and Equipment	17,501 07	17,809 75	—308 68
Travel	22,000 00	21,608 12	391 88
Waltham Field Station	6,601 75	6,561 60	40 15
Short Courses:			
Travel	1,600 00	1,461 94	138 06
Office and other Expenses	9,544 91	9,166 61	378 30
Heat, Light and Power	65,160 13	44,108 71	21,051 42
Farm	2,021 48	—3,836 26	5,857 74
Repairs Ordinary	15,454 33	27,254 86	—11,800 53
Replacements	20,119 00	19,797 88	321 12
Fertilizer Control Law:			
Travel	1,300 00	955 96	344 04
Office and other Expenses	2,300 00	2,699 14	—399 14
Poultry Disease Law:			
Travel	4,300 00	3,276 53	1,023 47
Office and other Expenses	11,700 00	11,843 22	—143 22
Dairy Law:			
Travel	700 00	370 22	329 78
Office and other Expenses	100 00	514 32	—414 32
Trustees' Expenses	1,200 00	795 34	404 66
Printing Reports	2,277 05	1,137 42	1,139 63
Feed Control Law:			
Travel	700 00	449 04	250 96
Office and other Expenses	1,336 95	1,724 62	—387 67
Seed Control Law:			
Travel	–	71 66	—71 66
Office and other Expenses	1,492 16	1,647 01	—154 85
Laboratory Service	600 00	488 44	111 56
Sub-total	$315,680 14	$292,976 99	$22,703 15
Total Maintenance	$1,043,225 74	$1,020,520 38	$22,705 36
College Department:			
Dean's Office	$12,974 34	$12,953 46	$20 88
Executive Order	12,684 07	11,009 70	1,674 37

College Department — *Concluded*	Appropriation	Current Year	Balances
President's Office	$19,390 54	$19,783 69	—$393 15
Treasurer's Office	21,780 07	21,901 17	—121 10
Agricultural Economics	8,250 00	8,315 84	—65 84
Agricultural Education	8,420 57	8,481 00	—60 43
Agricultural Engineering	5,184 34	5,228 17	—43 83
Agronomy	5,021 75	5,034 60	—12 85
Animal Husbandry	4,327 32	4,339 11	—11 79
Bacteriology and Physiology	12,556 00	12,560 94	—4 94
Beekeeping	2,480 00	2,443 46	36 54
Botany	14,600 00	14,331 63	268 37
Chemistry	22,349 57	22,283 26	66 31
Dairying	49,804 28	53,415 03	—3,610 75
Economics, History and Sociology	7,450 00	7,436 75	13 25
Entomology	11,403 58	11,339 00	64 58
Farm	38,821 48	34,630 72	4,190 76
Farm Management	5,782 50	5,797 12	—14 62
Floriculture	10,491 67	10,628 62	—136 95
Forestry	2,765 00	2,765 59	—59
Freshman Agriculture	1,510 00	1,507 42	2 58
General Agriculture	1,750 00	1,750 00	–
General Expense	248 09	5,050 35	—4,802 26
General Horticulture	18,736 55	18,482 58	253 97
Graduate School	100 00	72 78	27 22
Grounds	11,491 12	11,537 22	—46 10
Home Economics	13,916 55	13,759 23	157 32
Horticultural Manufactures	8,141 40	8,119 86	21 54
Hospital	4,881 62	4,325 85	555 77
Landscape Gardening	8,001 76	7,964 65	37 11
Language and Literature	21,651 70	21,578 42	73 28
Library	18,561 48	18,184 21	377 27
Mathematics	7,625 00	7,518 79	106 21
Military Science	2,643 53	2,670 17	—26 64
Mount Toby	2,410 75	2,688 89	—278 14
Physical Education	17,801 24	17,883 75	—82 51
Physics	7,091 06	7,084 99	6 07
Operating and Maintenance	180,842 16	163,427 51	17,414 65
Pomology	13,242 75	13,050 65	192 10
Poultry	26,550 73	25,400 33	1,150 40
Vegetable Gardening	8,250 00	8,325 63	—75 63
Veterinary	4,315 00	4,279 72	35 28
Zoölogy and Geology	5,055 00	5,153 67	—98 67
Salary Surplus	3,437 00	–	3,437 00
Total College Department	$664,791 57	$644,495 53	$20,296 04
Experiment Station Department:			
Administration	$10,111 51	$10,133 40	—$21 89
Agricultural Economics	150 00	150 05	— 05
Agricultural Engineering	1,700 00	1,699 99	01
Agronomy	5,486 04	5,485 46	58
Animal Husbandry	630 00	630 00	–
Bacteriology	540 00	534 22	5 78
Botany	11,211 30	11,234 27	—22 97
Chemistry	14,250 46	14,383 74	—133 28
Cranberry	10,958 05	11,239 78	—281 73
Dairy Industries	700 00	732 35	—32 35
Entomology	8,341 24	8,292 28	48 96
Farm Management	375 00	373 48	1 52
Floriculture	4,550 00	4,504 37	45 63

Experiment Station Department — *Concluded*	Appropriation	Current Year	Balances
Freight and Express	$300 00	$245 83	$54 17
Landscape Gardening	100 00	89 26	10 74
Library	350 00	349 86	14
Waltham Field Station	2,425 00	2,425 00	–
Pomology	7,251 00	7,213 36	37 64
Poultry Husbandry	10,230 29	9,954 17	276 12
Station Service	14,860 00	15,120 96	—260 96
Vegetable Gardening	1,460 00	1,433 10	26 90
Veterinary Science	1,150 00	1,040 72	109 28
Fertilizer Control Law	14,100 00	14,610 00	—510 00
Poultry Disease Law	37,500 00	36,730 97	769 03
Dairy Law	1,400 00	1,369 04	30 96
Feed Control Law	11,036 95	10,663 35	373 60
Seed Control Law	5,392 16	5,073 47	318 69
Laboratory Service	5,500 00	5,498 66	1 34
Salary Surplus	223 79	–	223 79
Total Experiment Station	$182,282 79	$181,211 14	$1,071 65
Extension Service:			
Administration	$16,507 99	$17,435 82	—$927 83
Agricultural Engineering	50 00	19 95	30 05
Animal Husbandry	3,367 44	3,605 03	—237 59
Child Development	3,014 08	2,550 20	463 88
Clothing	4,185 50	3,971 55	213 95
Co-op Marketing	3,369 60	3,457 24	—87 64
Correspondence Courses	1,000 38	635 30	365 08
County Agents	3,261 03	2,948 53	312 50
Crop Protection	62 63	39 92	22 71
Dairying	110 00	76 45	33 55
Exhibits	2,350 56	1,986 31	364 25
Extension Courses	5,018 09	5,172 86	—154 77
Farm Management	4,021 21	4,625 24	—604 03
Forestry	111 86	40 12	71 74
Home Demonstrations	4,724 90	4,196 41	528 49
Horticultural Manufactures	4,433 34	4,554 97	—121 63
Household Management	3,464 36	3,235 85	228 51
Junior Extension	16,845 13	16,640 68	204 45
Landscape Gardening	75 00	36 73	38 27
Lectures	410 00	247 42	162 58
Nutrition	4,341 53	4,252 81	88 72
Pomology	3,435 17	3,411 67	23 50
Poultry	3,805 49	3,786 00	19 49
Printing	8,553 87	9,199 77	—645 90
Soils and Crops	3,697 70	3,714 54	—16 84
Vegetable Gardening	1,813 95	2,187 77	—373 82
Salary Surplus	100 21	–	100 21
Plant Pathology	3,960 05	3,889 13	70 92
Total Extension Service	$106,091 07	$105,918 27	$172 80
Miscellaneous:			
Short Courses:			
Agricultural Economics	$2,125 00	$2,125 97	—$0 97
Agricultural Engineering	6,098 93	6,100 60	—1 67
Agronomy	3,599 28	3,587 65	11 63
Animal Husbandry	3,367 93	3,328 16	39 77

Miscellaneous — *Concluded*			
Short Courses — *Concluded*	Appropriation	Current Year	Balances
Bacteriology and Physiology	$2,650 74	$2,632 27	$18 47
Dairying	4,951 89	4,955 04	—3 15
Entomology	52 08	55 39	—3 31
Farm Management	1,657 50	1,679 41	—21 91
Floriculture	2,580 00	2,579 59	41
Forestry	25 00	16 66	8 34
General Horticulture	5,186 32	5,208 24	—21 92
Home Economics	1,553 29	1,514 16	39 13
Horticultural Manufactures	400 00	241 63	158 37
Library	50 00	20 76	29 24
Office	24,906 03	24,606 05	299 98
Physical Education	2,428 55	2,501 32	—72 77
Pomology	7,058 63	7,047 92	10 71
Poultry	1,750 00	1,749 53	47
Vegetable Gardening	1,792 33	1,740 53	51 80
Salary Surplus	—942 99	–	—942 99
Total Short Courses	$71,290 51	$71,690 88	—$400 37
Waltham Field Station	15,292 75	15,271 80	20 95
Trustees' Expenses	1,200 00	795 34	404 66
Printing Reports	2,277 05	1,137 42	1,139 63
Total Miscellaneous	$90,060 31	$88,895 44	$1,164 87
Grand Total Maintenance Appropriation	$1,043,225 74	$1,020,520 38	$22,705 36

Special Appropriations

	Appropriation	Expenditures to Date	Balance
1929 Building for Horticultural Manufactures	$54,755 78	$54,484 61	$271 17
1929 Emergency Needs	2,616 70	2,178 40	438 30[1]
1929 Abattoir for Animal Husbandry	5,304 73	4,699 56	605 17
1929 Renovation Dairy Laboratory	4,000 00	3,721 03	278 97[1]
1929 Garage Construction	127 13	88 76	38 37[1]
1929 Roads Construction	37 51	37 51	–
1929 Poultry House and Hot Water Brooder	645 78	632 30	13 48[1]
1929 Renovation Brooks Farm Barn	238 19	135 47	102 72[1]
1929 Greenhouses M. G. F. Station	12,540 47	12,445 40	95 07
1930 Emergency Needs	5,000 00	3,502 16	1,497 84
1930 Platform Scales	2,200 00	2,004 11	195 89
1930 Building for Physical Education	287,500 00	144,205 01	143,294 99
1930 Remodeling North College	30,000 00	29,232 16	767 84
1930 Addition Fisher Laboratory	8,000 00	6,973 41	1,026 59
1930 New Water Main	5,000 00	844 41	4,155 59
1930 Road Construction	378 90	378 90	–
	$418,345 19	$265,563 20	$152,781 99
Less reverted	–	–	438 30
			$152,343 69
Less reverted	–	–	433 54
			$151,910 15

[1] Reverted.

College Buildings (Estimated Value, 1930)

	Inventory at Beginning of Year	Per Cent deducted	Value at Beginning of Year less Deterioration	Repairs and Improvements during Year	Total Value at Close of Fiscal Year
Adams Hall	$115,892 83	3	$112,416 05	$4,300 89	$116,716 94
Agricultural Engineering Building	13,745 48	2	13,470 57	357 50	13,828 07
Apiary	2,665 36	2	2,612 05	13 00	2,625 05
Cashier's House	2,448 93	5	2,326 48	53 04	2,379 52
Chemistry Store House	44 19	2	43 31	–	43 31
Clark Hall	59,179 48	2	57,995 89	925 11	58,921 00
Draper Hall	73,313 00	3	71,113 61	3,841 14	74,954 75
Drill Hall and Gun Shed	24,771 68	5	23,533 10	359 00	23,892 10
Durfee Glass House, old	13,339 89	5	12,672 90	517 61	13,190 51
Durfee Glass House, new	8,704 88	5	8,269 64	1 40	8,271 04
Farm Shop	348 29	3	337 84	–	337 84
Farm Bungalow No. 1	2,748 00	3	2,665 56	222 63	2,888 19
Farm Bungalow No. 2	3,957 44	3	3,838 72	18 19	3,856 91
Farm Bungalow No. 3	3,837 54	3	3,722 41	–	3,722 41
Farm Bungalow Garage	315 87	5	300 08	–	300 08
Farm Bull Pens and Fence	3,812 85	5	3,622 21	95	3,623 16
Farm Corn Cribs (7)	586 62	5	557 29	–	557 29
Farm Dairy Barns and storage	27,382 64	3	26,561 16	518 16	27,079 32
Farm Horse Barn No. 1	4,644 08	3	4,504 76	133 31	4,638 07
Farm Horse Barn No. 2	5,323 58	3	5,163 87	–	5,163 87
Farm House	4,083 73	3	3,961 22	84 55	4,045 77
Farm Machinery Barn	3,248 93	3	3,151 46	35 87	3,187 33
Farm Piggery	2,416 09	3	2,343 61	18 37	2,361 98
Farm sheep barn	1,401 45	3	1,359 41	16 78	1,376 19
Farm young stock, including Isolation and Quarantine Barn	18,483 76	3	17,929 25	458 35	18,387 60
Fernald Hall	66,322 71	2	64,996 26	885 81	65,882 07
Fisher Laboratory	16,190 64	2	15,866 83	6,765 72	22,632 55
Flint Laboratory	67,666 04	2	66,311 72	5,555 92	71,867 64
French Hall	43,819 46	2	42,943 07	842 74	43,785 81
Garage (six) Farm	2,372 87	–	2,372 87	88 76	2,461 63
Goessmann Laboratory	266,866 67	2	261,529 34	1,118 87	262,648 21
Grinnell Arena and Abattoir	17,152 34	2	16,809 29	3,281 80	20,091 09
Grounds Tool Shed	140 21	3	136 00	–	136 00
Harlow House	1,621 32	5	1,540 25	57 11	1,597 36
Head of Division of Hort. House	3,044 07	5	2,891 87	51 28	2,943 15
Home Practice House for Girls	7,920 42	5	7,524 40	370 40	7,894 80
Horticultural Barn	3,944 27	3	3,825 94	139 69	3,965 63
Horticultural Garage	1,505 58	3	1,460 41	16	1,460 57
Horticultural Tool Shed	4,519 33	3	4,383 75	–	4,383 75
Horticultural Open Shed	326 93	5	310 58	–	310 58
Horticultural Manufactures Building	–	–	–	–	65,594 00
Horticultural Manufactures Shed	2,436 98	5	2,315 13	–	2,315 13
Hospital	16,309 13	2	15,982 95	428 29	16,411 24
Jewett House and Barn	2,928 84	5	2,782 40	124 50	2,906 90
Library	29,604 46	2	29,012 37	295 83	29,308 20
Mathematical Building	5,226 01	5	4,964 71	27 18	4,991 89
Memorial Hall	92,926 60	2	91,068 07	684 21	91,752 28
Microbiology Building	52,434 93	2	51,386 23	1,457 92	52,844 15
Military Storage	142 20	5	135 09	–	135 09
Mount Toby House and Barn	2,546 35	5	2,419 03	–	2,419 03
North Dormitory	29,866 19	2	29,268 87	23,870 42	53,139 29
Paige Laboratory and Stable	25,131 50	2	24,628 87	688 81	25,317 68
Physics Laboratory	8,380 72	5	7,961 68	801 72	8,763 40
Poultry Departments:					
No. 1, Demonstration Building	2,313 26	3	2,243 86	9 94	2,253 80
No. 2, Oil House	139 61	3	135 42	33	135 75
No. 3, Brooder, killing and fattening laboratory	2,900 39	3	2,813 38	73 31	2,886 69
No. 4, Mechanics, storage building and incubator cellar	3,922 60	3	3,804 92	6 99	3,811 91
No. 5, Laying house	2,111 57	3	2,048 22	6 33	2,054 55
No. 6, Manure Shed	134 92	3	130 87	–	130 87
No. 7, Small henhouse	51 06	3	49 53	–	49 53
No. 8, Breeding house	1,336 35	3	1,296 26	–	1,296 26
No. 9, Experimental Breeding House	606 80	3	588 60	–	588 60
No. 10, Duck House	107 89	3	104 65	–	104 65
No. 11, Unit House for 200 hens	434 30	3	421 27	11 10	432 37
No. 12, Unit house for 100 hens	404 55	3	392 41	–	392 41
No. 13, Hot Water Brooder	1,404 92	3	1,362 77	632 30	1,995 07
Power Plant and storage building including coal pocket	46,538 95	2	45,608 17	3,148 94	48,757 11
President's House	15,945 93	3	15,467 55	520 85	15,988 40
South Dormitory	46,023 58	2	45,103 11	2,486 59	47,589 70
Stockbridge Hall	151,996 14	2	148,956 22	3,063 14	152,019 36
Agronomy Greenhouse and Storage	4,471 34	2	4,381 91	70	4,382 61

College Buildings (Estimated Value, 1930) — *Concluded*

	Inventory at Beginning of Year	Per Cent deducted	Value at Beginning of Year less Deterioration	Repairs and Improvements during Year	Total Value at Close of Fiscal Year
Stockbridge House	$1,728 90	5	$1,642 45	$1 15	$1,643 60
Stable for cavalry unit	13,281 53	2	13,015 90	196 19	13,212 09
Blacksmith shop	658 83	2	645 65	–	645 65
Storage barn	2,748 88	2	2,693 90	–	2,693 90
Turbine House	16,065 83	2	15,744 51	617 93	16,362 44
Vegetable Plant House	4,463 15	5	4,239 99	538 50	4,778 49
Waltham Field Station:					
Greenhouses	12,913 16	5	12,267 50	14,904 93	27,172 43
Office and Laboratory Buildings	7,378 95	3	7,157 58	–	7,157 58
Farmhouse	4,782 03	5	4,542 93	625 28	5,168 21
Ice House	77 38	5	73 51	–	73 51
Hay Barn	3,500 00	5	3,325 00	–	3,325 00
Garage	–	–	–	–	1,000 00
Small stock barn	1,547 56	5	1,470 17	–	1,470 17
Small shed	612 16	5	581 55	–	581 55
Waiting Station	672 55	2	659 10	16 67	675 77
Wilder Hall	29,907 42	2	29,309 27	257 26	29,566 53
	$1,549,225 85	–	$1,511,578 56	$86,531 42	$1,664,703 98

Experiment Station Buildings (Estimated)

	Inventory at Beginning of Year	Per Cent deducted	Value at Beginning of Year less Deterioration	Repairs and Improvements during Year	Total Value at Close of Fiscal Year
Agricultural Laboratory	$13,865 67	2	$13,588 36	$236 60	$13,824 96
Agricultural Barn	5,732 23	3	5,560 26	74 62	5,634 88
Agricultural Farmhouse	7,591 39	5	7,211 82	20 27	7,232 09
Agricultural glasshouse	860 61	5	817 58	–	817 58
Brooks House	2,908 49	5	2,763 07	92 83	2,855 90
Brooks Barn and sheds	6,220 97	5	5,909 92	150 09	6,060 01
Brooks tobacco barn	2,324 00	5	2,207 90	–	2,207 90
Brooks farm garages	300 00	3	291 00	49 85	340 85
Cranberry Buildings:					
Laboratory	5,929 51	2	5,810 92	–	5,810 92
Garage	1,295 63	2	1,269 72	–	1,269 72
Shed (storage)	218 70	5	207 76	–	207 76
Pump House	141 46	5	134 39	–	134 39
Oil House	34 29	5	32 58	–	32 58
Entomological Glasshouses	433 36	5	411 69	–	411 69
Plant and Animal Chemistry Lab.	26,181 49	3	25,396 05	291 09	25,687 14
Plant and Animal Chemistry barns	6,484 83	3	6,290 29	291 21	6,581 50
Plant and Animal Chemistry barn annex	1,509 64	3	1,464 35	–	1,464 35
Six Poultry houses	622 57	3	603 89	–	603 89
Tillson cottage	1,461 89	5	1,388 80	–	1,388 80
Tillson barn	807 52	5	767 15	–	767 15
Tillson poultry houses (4) Nos. 1, 2, 3, 4	2,777 49	3	2,694 17	–	2,694 17
Tillson pullet brooder No. 5	901 75	5	856 66	–	856 66
Tillson hen brooder No. 6	937 74	5	890 85	–	890 85
Tillson summer sheds (3) 7–8–9	355 13	5	337 37	–	337 37
Tillson Foreman's quarters and incubator cellar No. 10	6,509 52	5	6,184 04	7 71	6,191 75
	$96,405 88	–	$93,090 58	$1,214 27	$94,304 85

College Equipment (Estimated Value)

Administrative Division:	
Dean's Office	$2,125 10
President's Office	3,351 19
Treasurer's Office	4,392 10
Agricultural Division:	
Agricultural Engineering	8,408 39
Agronomy	9,353 22
Animal Husbandry	4,003 05
Dairy	27,290 78

Agricultural Division — *Concluded*	
Farm, including livestock	$75,626 12
Farm Management	1,868 02
Freshman Agriculture	181 66
Poultry	7,900 53
Home Economics	8,920 52
Dining Hall	26,651 60
Extension Service	21,041 70
General Science:	
Apiary	2,830 97
Bacteriology and Physiology	29,282 10
Botany	27,042 83
Chemistry	36,252 34
Entomology, Zoölogy and Geology	54,213 49
Mathematics	2,399 25
Physics	13,337 09
Veterinary	14,071 00
Graduate School	197 45
Horticultural Division:	
Floriculture	38,144 36
Forestry	1,755 16
General Horticulture	7,522 14
Grounds	2,163 60
Horticultural Manufactures	11,098 30
Landscape Architecture	5,866 91
Waltham Field Station	5,504 67
Mount Toby Reservation	337 17
Pomology	8,985 20
Vegetable Gardening	3,799 73
Hospital	1,080 70
Language and Literature	1,092 93
Library	166,800 79
Memorial Hall	12,718 91
Military	2,269 30
Operating and Maintenance:	
College supplies	987 48
Janitor supplies	1,482 67
Fire apparatus	1,559 08
General Maintenance:	
Office	879 14
Carpentry and masonry supplies	6,470 14
Carpentry and masonry tools	4,600 45
Electrical supplies	5,899 04
Electrical tools	436 80
Electrical supplies for Commencement	225 47
Heating and plumbing supplies	14,013 38
Heating and plumbing tools	3,003 34
Painting supplies	1,430 14
Painting tools	318 52
Gas Main	828 46
Steam main	14,777 92
Lighting Lines	14,280 22
Sewer Line	12,085 25
Water Main	14,782 98
Roads and Walks	44,586 54
Power Plant:	
General Equipment	77,283 93
Tools	344 78
Fuel	12,448 06

Operating and Maintenance — *Concluded*	
General Agriculture	$3,174 78
Women's Dormitory	9,332 20
North College	6,573 60
South College	2,287 35
Physical Education	1,734 89
Rural Social Science:	
Agricultural Economics	2,120 51
Agricultural Education	1,821 58
Economics, History and Sociology	215 06
Short Courses	2,862 58
Social Union and Trophy Room and Interchurch	500 00
Text Books	1,410 82
Total	$914,637 53

Experiment Station Equipment (Estimated Value)

Agricultural Economics	$682 95
Agricultural Engineering	464 75
Agricultural Laboratory	11,134 14
Agronomy	337 26
Bacteriology and Physiology	1,678 91
Botany	10,517 00
Cranberry Station	10,692 79
Director's Office	5,967 45
Entomological Laboratory and Apiary	25,635 03
Entomology at Waltham Field Station	347 80
Floriculture at Waltham Field Station	327 45
Feed and Fertilizer Law	10,420 39
Meteorological Observatory	739 35
P and A Chemistry	19,281 95
Pomology	7,828 48
Poultry	6,952 45
Poultry Disease Law	27,654 32
Seed Control Law	2,638 79
Treasurer's Office	786 62
Veterinary	2,440 93
Laboratory Service:	
Pathology	268 56
Bacteriology	1,520 79
	$148,318 16

Inventory — Real Estate (Estimated Value)

Angus Land	$800 00
Allen Place	500 00
Baker Place	2,500 00
Bangs Place	2,350 00
Brooks Farm	11,000 00
Brown Land	500 00
Chambury Place	450 00
Clark Place	4,500 00
College Farm	37,000 00
Cranberry Land	16,300 00
George Cutler, Trustee	2,700 00
Dickinson Land	7,850 00
Harlow Farm and Orchard	3,284 63
Hawley and Brown Place	675 00

Kellogg Place	$3,368 45
Loomis Place	415 00
Louisa Baker Place	5,000 00
Mount Toby Demonstration Forest	30,000 00
Newell Farm	2,800 00
Old Creamery Place	1,000 00
Owen Farm	5,000 00
Pelham Quarry	500 00
Q. T. V. Land	12,000 00
Tillson Farm	2,950 00
Waltham Field Station	21,000 00
Westcott Land	2,250 00
	$176,693 08

	Acres
College Estate (area)	705.59
Cranberry Station, Wareham (area)	28.36
Mount Toby Demonstration Forest (area)	755.27
Rifle Range	46.20
Pelham Quarry	.50
Waltham Field Station, Waltham (area)	55.39
	1,591.31

SUMMARY

Land	$176,693 08
College Buildings	1,664,703 98
College Equipment	914,637 53
Experiment Station Buildings	94,304 85
Experiment Station Equipment	148,318 16
Total	$2,998,657 60

DINING HALL STATEMENT NOVEMBER 30, 1930

Balance Dec. 1, 1929		$14,103 47
Total Disbursements Nov. 29, 1930	$106,214 41	
Outstanding Bills Nov. 29, 1930	859 30	
Outstanding Accounts:		
Board		142 16
Special Service		95 53
Inventory Nov. 29, 1930		5,058 96
Total Collections		108,355 50
Balance	20,681 91	
	$127,755 62	$127,755 62

Special Funds

Burnham Emergency Fund

	Market Value Dec. 1, 1930	Par Value	Income
One bond Indianapolis Water Works Securities 5s	$463 00	$500 00	$25 00
One bond Jersey Central Power and Light Co. 5½s	510 00	500 00	27 50
Two bonds Narragansett Co. 5s @ 102	2,040 00	2,000 00	100 00
Two bonds Power Corp. of New York 6½s @ 103	2,060 00	2,000 00	130 00
	$5,073 00	$5,000 00	$282 50
Unexpended balance Dec. 1, 1929	–	–	597 10
	–	–	$879 60
Disbursements for fiscal year ending Nov. 30, 1930	–	–	533 26
Cash on hand Nov. 30, 1930	–	–	$346 34

Library Fund

	Market Value Dec. 1, 1930	Par Value	Income
One bond Cities Service Power and Light 5½s	$840 00	$1,000 00	$55 00
Four bonds Illinois Power and Light Corp. 5s @ 95	3,800 00	4,000 00	200 00
Five bonds New York Central and Hudson River R.R. 4s @ 100½	5,025 00	5,000 00	200 00
Two shares New York Central stock @ 127	254 00	200 00	16 00
Amherst Savings Bank deposit	175 52	175 52	8 86
	$10,094 52	$10,375 52	$479 86
Disbursements for fiscal year ending Nov. 30, 1930	–	–	479 46
Cash on hand Nov. 30, 1930	–	–	$0 40

Endowed Labor Fund (Gift of a Friend of the College)

Two bonds Cities Service Power and Light 5½s @ 84	$1,680 00	$2,000 00	$110 00
One bond Jersey Central Power and Light 5½s	1,020 00	1,000 00	55 00
Two bonds Narragansett Co. 5s @ 102	2,040 00	2,000 00	100 00
One bond New York Central and Hudson River 4s	940 00	1,000 00	40 00
One bond State and Washington Building 5s	800 00	1,000 00	50 00
Two bonds Texas-Louisiana Power Co. 6s @ 97½	1,950 00	2,000 00	120 00
	$8,430 00	$9,000 00	$475 00
Unexpended balance Dec. 1, 1929	–	–	378 17
	–	–	$853 17
Disbursements for year ending Nov. 30, 1930	–	–	217 00
Cash on hand Nov. 30, 1930	–	–	$636 17

Whiting Street Scholarship Fund

One bond New York Central & Hudson River 4s	$1,005 00	$1,000 00	$40 00
One bond Texas-Louisiana Power Co. 6s	975 00	1,000 00	60 00
	$1,980 00	$2,000 00	$100 00
Unexpended balance Dec. 1, 1929	–	–	137 06
Cash on hand Nov. 30, 1930	–	–	$237 06

Hills Fund

Boston & Albany R.R. stock 3⅜ shares @ 180	$652 50	$362 00	$31 68
One bond New England Power Ass'n 5½s	940 00	1,000 00	–
One bond Indianapolis Water Works Securities 5s	925 00	1,000 00	50 00
One bond Monongahela West Penn Public Service 5½s	975 00	1,000 00	55 00
One bond Narragansett Co. 5s	1,020 00	1,000 00	50 00
One bond New York Central 4s	1,005 00	1,000 00	40 00
One bond Oklahoma Gas and Electric Co. 6s	985 00	1,000 00	60 00
Three bonds Pacific Telephone and Telegraph Co. 5s @ 98	2,955 00	3,000 00	150 00
Prudence Bonds Corp. 1⅝₀ bonds 5½ @ 96	1,133 00	1,180 00	64 90
One bond State and Washington Bldg. 5s	800 00	1,000 00	50 00
One bond New York Central & Hudson River 4s	1,005 00	1,000 00	40 00
Two bonds Texas-Louisiana Power Co. 6s @ 97½	1,950 00	2,000 00	120 00
Amherst Savings Bank	72 75	72 75	3 65
Prudence & Company 5½s @ 96	1,440 00	1,500 00	82 50
	$15,858 25	$16,114 75	$797 73
Unexpended balance Dec. 1, 1929	–	–	241 53
Great Western Power Co. of Calif.	–	–	27 50
Difference between cost and par value of bonds	–	–	24 59
	–	–	$1,091 35
Disbursements for fiscal year ending Nov. 30, 1930	–	–	726 34
Cash on hand Nov. 30, 1930	–	–	$365 01

Mary Robinson Fund

Boston & Albany R.R. stock ⅜ share @ 180	$67 50	$38 00	$3 32
Prudence Bonds Corp. 4½₀ bonds @ 96	787 00	820 00	45 10
Amherst Savings Bank deposit	142 00	142 00	7 18
	$996 50	$1,000 00	$55 60
Unexpended balance Dec. 1, 1929	–	–	281 90
Cash on hand Nov. 30, 1930	–	–	$337 50

Grinnell Prize Fund

Ten shares New York Central stock @ 127	$1,270 00	$1,000 00	$80 00
Unexpended balance Dec. 1, 1929	–	–	486 87
	–	–	$566 87
Disbursements for prizes	–	–	50 00
Cash on hand Nov. 30, 1930	–	–	$516 87

Gassett Scholarship

	Market Value Dec. 1, 1930	Par Value	Income
One bond New York Central & Hudson River 4s	$1,005 00	$1,000 00	$40 00
One bond Prudence & Co. 5½s	480 00	500 00	27 50
	$1,485 00	$1,500 00	$67 50
Unexpended balance Dec. 1, 1929	–	–	93 17
Cash on hand Nov. 30, 1930	–	–	$160 67

Massachusetts Agricultural College (Investment)

Five shares New York Central R.R. stock @ 127	$635 00	$500 00	$36 00
Unexpended balance Dec. 1, 1929	–	–	65 76
Cash on hand Nov. 30, 1930	–	–	$101 76

Danforth Keyes Bangs Fund

Two bonds Narragansett Company 5s @ 102	$2,040 00	$2,000 00	$100 00
Two bonds Pacific Telephone and Telegraph Co. 5s @ 104	2,080 00	2,000 00	100 00
One bond State and Washington Bldg. 5s	800 00	1,000 00	50 00
Two bonds Union Electric Light and Power Co. 5s @ 101½	2,030 00	2,000 00	100 00
Interest from student loans	–	–	199 55
	$6,950 00	$7,000 00	$549 55
Unexpended balance Dec. 1, 1929	–	–	2,203 08
	–	–	$2,752 63
Total loans made to students during fiscal year, $5,780.50	–	–	–
Cash received on account of student loans, $6,249.45	–	–	–
Excess accounts paid over loans made to students	–	–	468 95
Cash on hand Nov. 30, 1930	–	–	$3,221 58

John C. Cutter Fund

One bond Pacific Telephone and Telegraph Co. 5s	$1,040 00	$1,000 00	$50 00
Unexpended balance Dec. 1, 1929	–	–	73
	–	–	$50 73
Disbursements for fiscal year ending Nov. 30, 1930	–	–	47 35
Cash on hand Nov. 30, 1930	–	–	$3 38

Robert F. Pomeroy Library Fund

Two bonds Indiana Hydro-Electric Power Co. 5s @ 91	$1,365 00	$1,500 00	$75 00
Unexpended balance Dec. 1, 1929	–	–	62 53
	–	–	$137 53
Disbursements for fiscal year ending Nov. 30, 1930	–	–	26 06
Cash on hand Nov. 30, 1930	–	–	$111 47

William R. Sessions Fund

Three bonds Indianapolis Water Works Securities 5s @ 92	$2,313 00	$2,500 00	$125 00
Five shares New York Central stock @ 127	635 00	500 00	40 00
One bond Power Corp. of New York 5½s	940 00	1,000 00	55 00
One bond Southern Illinois Light and Power Co. 6s	1,000 00	1,000 00	60 00
	$4,888 00	$5,000 00	$280 00
Unexpended balance Dec. 1, 1929	–	–	572 27
	–	–	$852 27
Disbursements for fiscal year ending Nov. 30, 1930	–	–	754 27
Cash on hand Nov. 30, 1930	–	–	$98 00

Alvord Dairy Scholarship Fund

Two bonds New England Power Assoc. 5½s @ 94	$1,880 00	$2,000 00	–
One bond Indianapolis Water Works Securities 5s	925 00	1,000 00	$50 00
One bond Jersey Central Power and Light Co. 5½s	1,020 00	1,000 00	55 00
	$3,825 00	$4,000 00	$105 00
Unexpended balance Dec. 1, 1929	–	–	688 52
Amherst Savings Bank (Interest)	–	–	25 32
Great Western Power Co. of Calif.	–	–	55 00
Difference between cost and par value of bonds	–	–	49 19
	–	–	$923 03
Disbursements for fiscal year ending Nov. 30, 1930	–	–	106 45
Cash on hand Nov. 30, 1930	–	–	$816 58

J. D. W. French Fund

	Market Value Dec. 1, 1930	Par Value	Income
Two bonds New England Power Assn. 5½s @ 94	$1,880 00	$2,000 00	–
Two bonds Jersey Central Power and Light Co. 5½s at 102	2,040 00	2,000 00	$110 00
Four bonds Oklahoma Gas and Electric Co. 6s @ 98	3,940 00	4,000 00	240 00
Two bonds Southern Illinois Light and Power Co. 6s @ 100	2,000 00	2,000 00	120 00
	$9,860 00	$10,000 00	$470 00
Unexpended balance Dec. 1, 1929	–	–	1,188 21
Amherst Savings Bank (Interest)	–	–	25 31
Great Western Power Co. of Calif.	–	–	55 00
Difference between cost and par value of bonds	–	–	49 19
	–	–	$1,787 71
Disbursements for fiscal year ending Nov. 30, 1930	–	–	829 00
Cash on hand Nov. 30, 1930	–	–	$958 71

F. G. Crane Fund

Five bonds Illinois Power and Light Corp. 6s @ 102	$5,100 00	$5,000 00	$300 00
Five bonds Jersey Central Power and Light Co. 5½s @ 102	5,100 00	5,000 00	275 00
Four bonds Monongahela West Penn Pub. Service 5½s @ 97½	3,900 00	4,000 00	220 00
Four bonds Northern New York Utilities 6s @ 101	4,040 00	4,000 00	240 00
Two bonds Power Corp. of New York 6½s @ 103	2,060 00	2,000 00	130 00
Five bonds Florida Power Corp. 5½s @ 84	4,200 00	5,000 00	275 00
Amherst Savings Bank	250 00	250 00	12 65
	$24,650 00	$25,250 00	$1,452 65
Unexpended balance Dec. 1, 1929	–	–	2,513 17
	–	–	$3,965 82
Cash scholarships	–	–	1,639 95
Cash on hand Nov. 30, 1930	–	–	$2,325 87

Charles A. Gleason Fund

Five bonds Prudence & Co. 5½s @ 96	$4,800 00	$5,000 00	$275 00
Interest from student loans	–	–	7 60
	–	–	$282 60
Unexpended balance Dec. 1, 1929	–	–	562 62
	–	–	$845 22
Total loans made to students during fiscal year, $834.00	–	–	–
Cash received on account of student loans, $859.00	–	–	–
Excess of accounts paid over loans made to students	–	–	25 00
Cash on hand Nov. 30, 1930	–	–	$870 22

Porter L. Newton Fund

Eight bonds Brown Co. 5½s @ 90	$7,200 00	$8,000 00	$440 00
Five bonds Illinois Power and Light Corp. 5½s @ 100	5,000 00	5,000 00	275 00
Five bonds Puget Sound Power and Light 5½s @ 101	5,050 00	5,000 00	275 00
Five bonds Virginia Electric and Power Co. 5s @ 101½	5,075 00	5,000 00	250 00
Amherst Savings Bank Deposit	411 33	411 33	20 81
	$22,736 33	$23,411 33	$1,260 81
Unexpended balance Dec. 1, 1929	–	–	1,129 82
	–	–	$2,390 63
Cash scholarships	–	–	1,200 00
Cash on hand Nov. 30, 1930	–	–	$1,190 63

George H. Barber Fund

Five bonds Florida Power and Light Co. 5s @ 83½	$4,175 00	$5,000 00	$250 00
Unexpended balance Dec. 1, 1929	–	–	2 58
	–	–	$252 58
Disbursements for fiscal year ending Nov. 30, 1930	–	–	252 58
	–	–	–

Helen A. Whittier Scholarship

	Market Value Dec. 1, 1930	Par Value	Income
One bond Cities Service Power and Light Co. 5½s	$840 00	$1,000 00	$27 50
One bond Illinois Power and Light Corp. 6s	1,020 00	1,000 00	60 00
One bond Gateneau Power 5s	930 00	1,000 00	25 00
	$2,790 00	$3,000 00	$112 50
Difference between cost and par value of bonds	–	–	107 50
	–	–	$220 00
Expense in connection of buying bonds	–	–	14 72
	–	–	$205 28
Cash scholarships	–	–	50 00
Cash on hand Nov. 30, 1930	–	–	$155 28

Trust Account

Massachusetts Agricultural College — Student Loan Fund

Total amount of gift	$500 00	$500 00	–
Total loans	–	397 00	–
Amount available for loans	–	$103 00	–
Unexpended balance Dec. 1, 1929	–	–	$80 76
Interest from loans	–	–	1 00
	–	–	$81 76

4-H Club for Boys

Total amount of gift	$1,000 00	$1,000 00	–
Total loans	–	395 00	–
Amount available for loans	–	$605 00	–
Interest from Loans	–	–	$40 57

4-H Club for Girls

Total amount of gift	$100 00	$100 00	–
Total Loans	–	100 00	–
	–	–	–

Vincent Goldthwaite Loan

Total amount of gift	$1,175 00	$1,175 00	–
Total loans	–	320 00	–
Amount available for loans	–	$855 00	–

Summary

M. A. C. Club—Student loan fund	–	$184 76	–
4-H Club for Boys	–	645 57	–
4-H Club for Girls	–	–	–
Vincent Goldthwaite Fund	–	855 00	–
	–	$1,685 33	–

Outstanding Notes

Mass. Agric. Club	$397 00
4-H Club for Boys	395 00
Vincent Goldthwaite Fund	320 00
4-H Club for Girls	100 00
	$1,212 00

Summary of Balance on Hand of the Income from Funds Held in Trust by the Mass. Agric. College

Burnham Emergency Fund	$346 34
Library Fund	40
Endowed Labor Fund	636 17
Whiting Street Scholarship Fund	237 06
Hills Fund	365 01
Mary Robinson Fund	337 50
Grinnell Prize Fund	516 87
Gassett Scholarship Fund	160 67

Massachusetts Agricultural College Investment Fund	$101 76
Danforth Keyes Bangs Fund	3,221 58
John C. Cutter Fund	3 38
Robert F. Pomeroy Library Fund	111 47
William R. Sessions Fund	98 00
Alvord Dairy Scholarship Fund	816 58
J. D. W. French Fund	958 71
Helen A. Whittier Scholarship Fund	155 28
F. G. Crane Fund	2,325 87
Charles A. Gleason Fund	870 22
Porter L. Newton Fund	1,190 63
George H. Barber Fund	–
	$12,453 50
M. A. C. Club	184 76
4-H Club for Boys	645 57
Vincent Goldthwaite Fund	855 00
	$14,138 83

I hereby certify that I have this day examined the special funds of the Massachusetts Agricultural College, as reported by the Treasurer, Fred C. Kenney, for the year ending November 30, 1930. All bonds and investments are as represented in the Treasurer's report. All disbursements are properly vouched for, and all cash balances are found to be correct.

FRANK GERRETT,
Auditor.

STATISTICS

TABLE I. — NEW APPOINTMENTS

A. In the Academic Departments

Assistant Professor of Landscape Architecture and Superintendent of Grounds: William H. Armstrong, B.S., Massachusetts Agricultural College, 1899; M.L.A., Harvard, 1927.

Junior Clerk, Farm Department: Ida M. Ball.

Instructor in English: Ellsworth Barnard, B.S., Massachusetts Agricultural College, 1928; M.A., University of Minnesota, 1929.

Junior Clerk, Dean's Office: Esther M. Bartlett.

Instructor in Botany: Robert P. Canis, B.S., Rutgers, 1929; M.S., Rutgers, 1930.

Instructor in German: Fred C. Ellert, B.S., Massachusetts Agricultural College, 1930.

Field Agent: George E. Emery, B.S., Massachusetts Agricultural College, 1925.

Junior Library Assistant: Hermon U. Goodell, B.S., Massachusetts Agricultural College, 1930.

Assistant Professor of Zoölogy: Frank C. Grannis, B.S., University of Illinois, 1910; M.S., Lincoln Memorial University, 1922.

Instructor in Agronomy: Jay L. Haddock, B.S., Brigham Young University, 1930.

Professor of Forestry: Robert P. Holdsworth, B.S., Michigan State College, 1911; M.F., Yale, 1928.

Junior Clerk, Treasurer's Office: Julia F. Kittredge.

Resident Nurse: Edna M. Machon.

Military Property Clerk: Jonathan Madden.

Technical Assistant in Entomology: Miriam Morse, B.S., St. Lawrence University, 1927; M.S., Massachusetts Agricultural College, 1930.

Instructor in English: William R. Phinney, B.S., Massachusetts Agricultural College, 1930.

Professor of Hygiene and Student Health Officer: Ernest J. Radcliffe, M.B., University of Toronto, 1923; M.D., University of Toronto, 1929.

Instructor in Horticultural Manufactures: Cecil C. Rice, B.S., Massachusetts Agricultural College, 1928.
Instructor in French and Spanish: Mrs. Elizabeth S. Robertson, B.S., Massachusetts Agricultural College, 1929; M.A., Cornell, 1930.
Instructor in Landscape Architecture: James Robertson, Jr., B.A., Carnegie Institute of Technology, 1930.
Assistant Professor of Entomology: Harvey L. Sweetman, B.S., Colorado Agricultural College, 1923; M.S., Iowa State College, 1925; Ph.D., Massachusetts Agricultural College, 1930.
Instructor in Botany: G. Bernard VanVeghten, B.S., New York State College of Agriculture, 1930.

B. In the Experiment Station

Research Assistant in Chemistry: Emmett Bennett, B.S., Ohio State University, 1929.
Research Assistant in Horticultural Manufactures: John A. Clague, B.S., University of Washington, 1929.
Laboratory Assistant in Agricultural Economics; J. Elizabeth Donley, A.B., Mt. Holyoke, 1930.
Technical Assistant in Floriculture: Edward B. Donnelly.
Assistant Research Professor of Veterinary Science: Charles S. Gibbs, B.S., Bates, 1916; M.S., Yale, 1920; Ph.D., Yale, 1921.
Laboratory Assistant in Home Economics: Oreana A. Merriam, B.S., University of Vermont, 1929.
Technical Assistant in Animal Nutrition: Leonard R. Parkinson.
Research Assistant in Farm Management: Doris E. Washburn, A.B., Mt. Holyoke, 1929; B.S., Simmons, 1930.
Assistant Research Professor of Floriculture: Harold E. White, B.S., Purdue, 1928; M.S., Purdue, 1929.

C. In the Control Service

Assistant Research Professor: Oliver S. Flint, B.S., Massachusetts Agricultural College, 1917.
Junior Chemist: George J. Larsinos, B.S., Massachusetts Agricultural College, 1926; M.S., Massachusetts Agricultural College, 1928.
Junior Clerk: Margaret E. Nagle.
Junior Chemist: Albert F. Spelman, B.S., Massachusetts Agricultural College, 1927.

D. In the Extension Service

Assistant Specialist in Agricultural Economics: Ellsworth W. Bell, B.S., Pennsylvania State College, 1926; M.S., University of Vermont, 1928.
Extension Specialist in Plant Pathology: Oran C. Boyd, B.S., in Agriculture, Oklahoma Agricultural and Mechanical College, 1916; Ph.D., Cornell, 1923.
Junior Clerk: Emily M. Larkin.
Senior Clerk: Esther C. Neely.

E. In the Short Courses

Instructor in Vegetable Gardening: Alden P. Tuttle, B.S., Massachusetts Agricultural College, 1928; M.S., Pennsylvania State College, 1930.

TABLE II. — SPEAKERS FOR THE YEAR

A. Assembly

1929

Dec. 5. Walter A. Dyer, Amherst, Mass.
Dec. 12. President George A. Works, Connecticut Agricultural College.

1930

Jan. 8. President Roscoe W. Thatcher, M. A. C.
Jan. 15. Earle S. Draper, Charlotte, N. C., M. A. C., 1915.
Jan. 22. Professor Fred C. Sears, M. A. C.

1930

Jan. 29. Edward C. R. Bagley, Massachusetts Department of Correction.
Feb. 5. Dr. Allyn K. Foster, Board of Education, Northern Baptist Convention.
Feb. 12. George E. Emery, M. A. C., 1925.
Feb. 26. Hon. Herbert Parker, Chairman, Massachusetts Bay Colony Tercentenary Commission.
Mar. 5. Frederick R. Strasburg, Wilbraham Academy.
Mar. 12. Hon. Charles P. Howard, Chairman, Massachusetts Commission on Administration and Finance.
Apr. 2. President Roscoe W. Thatcher, M. A. C.
Apr. 9. Musicale, Smith College Sextet.
Apr. 16. Miss Harriet Whittier, League of Nations Association.
Apr. 23. Mr. Kenneth J. Beaton, Canadian Secretary, Student Volunteer Movement.
Apr. 30. Mr. Gaylord W. Douglass, Associate Secretary, National Council for the Prevention of War.
May 21. Mr. Dudley Harmon, Executive Vice President, New England Council.
May 28. Dean Charles R. Brown, Divinity School, Yale University.
June 4. Musicale, M. A. C. Orchestra.
Sept. 24. President R. W. Thatcher, M. A. C.
Oct. 29. Dr. George D. Olds, Amherst. Scholarship Assembly.
Nov. 12. Mr. James R. Brown, Manhattan Single Tax Club.

1929 *B. Sunday Chapel*

Dec. 8. Dr. Alfred E. Stearns, Principal, Phillips Academy, Andover, Mass.
Dec. 12. Rev. Reinhold Niebuhr, Bethel Church, Detroit, Mich.

1930

Jan. 5. Professor Henry H. Tweedy, Yale Divinity School.
Jan. 12. Rev. John A. Hawley, Amherst.
Jan. 19. Mr. J. Paul Williams, M. A. C.
Jan. 26. Dr. D. Brewer Eddy, American Board of Commissioners for Foreign Missions.
Feb. 2. Rev. J. Elliot Ross, C.S.P., Chaplain, Newman Hall, N. Y.
Feb. 9. Dean Shailer Mathews, the Divinity School, University of Chicago.
Feb. 16. Dr. Bernard I. Bell, Warden, St. Stephen's College, Columbia University.
Feb. 23. President J. Edgar Park, Wheaton College.
Mar. 2. Professor Harold E. B. Speight, Dartmouth College.
Mar. 9. Rev. Samuel Macaulay Lindsay, Baptist Church, Brookline, Mass.
Mar. 16. Rev. Nehemiah Boynton, Newton Center, Mass.
Apr. 6. Professor Henry P. VanDusen, Union Theological Seminary.
Apr. 13. Rev. Arthur C. McGiffert, Jr., Chicago Theological Seminary.
Apr. 20. Bishop Francis J. McConnell, The Methodist Episcopal Church, New York.
Nov. 2. Rev. James Gordon Gilkey, South Congregational Church, Springfield, Mass.
Nov. 9. Professor Rufus M. Jones, Haverford College, Haverford, Penn.
Nov. 16. Rev. W. Russell Bowie, Grace Church, New York City.
Nov. 23. Rev. Bernard C. Clausen, First Baptist Church, Syracuse, N. Y.

TABLE III. — ATTENDANCE

	Registration Nov. 1, 1929			Registration Nov. 1, 1930		
	Men	Women	Total	Men	Women	Total
A. In the Work of College Grade						
Graduate Students	41	7	48	56	9	65
Senior Class	87	28	115	84	30	114
Junior Class	87	28	115	95	30	125
Sophomore Class	123	37	160	122	42	164
Freshman Class	155	45	200	178	61	239
Special Students	2	–	2	3	–	3
Totals	495	145	640	538	172	710
B. Stockbridge School						
Second year	98	10	108	89	4	93
First year	109	5	114	136	11	147
Totals	207	15	222	225	15	240
C. Short Course Enrollment						
Winter School	47	6	53	79	4	83
Summer School	53	111	164	65	89	154
Totals	100	117	217	144	93	237

D. Educational Meetings	1929	1930
Adult Leaders in Food Preservation	–	40
American Alumni Council	–	150
Annual Extension Service Conference	125	125
Boston Market Gardeners' Association at Field Station	150	200
Camp Gilbert (4-H Club members and leaders)	160	180
Canadian Tobacco Growers	50	–
College Stock Judging Teams	20	–
Connecticut Poultry Breeders	30	–
Connecticut Valley Day	300	350
Connecticut Valley Section, American Chemical Society	–	100
Connecticut Valley Student Volunteer Association	20	–
Dad's Day	140	150
Eastern College Personnel Officers' Association	–	69
Eastern Farm Bureau Training School	125	–
Eastern States Farmers Exchange	35	–
English Folk Dance School	140	130
Extension Home Economics Conference	25	30
Fall Horticultural Exhibition	2,000	2,600
Farm and Home Week	3,500	3,600
Field Day, Market Garden Field Station	900	900
4-H Canning and Garden Leaders	60	40
4-H Club Agents' Conference	30	30
4-H Garden Club, Field Station	–	100
4-H Sewing Contest	–	35
Greenkeepers' Exhibition	1,000	450
Hampden County Commercial Canners' Association	10	–
Hampden County Poultry Association	–	50
Hampden County Women's Club	250	174
Hampden, Franklin Holstein-Friesian Club	75	–
Hampshire County Poultry Association	20	–
High School Day	940	923
Holstein Breeders' Association	50	–
Interscholastic Judging Contests	–	200
Local Unit, F. T. D. A.	–	50
Massachusetts Elementary Principals' Association	300	–

	1929	1930
Massachusetts Veterinary Association	33	40
Middlesex County 4-H Club Champions	80	85
Mt. Holyoke College Student Group	15	15
New England Ayrshire Breeders' Association	30	–
New England Grange Lecturers' Conference	1,000	–
Northampton Florists' and Garden Club	25	25
Pasture Field Day	–	95
Poultry Breeders' Conference	150	100
Poultry Inspectors	–	35
Rhode Island Holstein-Friesian Club	–	20
Rural Ministers, Field Station	–	50
Shelburne Falls Garden Club	–	15
Smith College Class	–	20
State 4-H Dairy Club	60	150
Three County Fruit Meeting	125	150
Tobacco Field Day	60	100
Vocational Agricultural Teachers at Field Station	30	–
Women's Advisory Council	40	–
Women's 4-H Club Agents' Conference	10	8
Totals	12,113	11,584

Table IV. — Statistics of Freshmen Entering in September, 1930

A. *Home Addresses of Students (classified by Towns and Cities)*

Acton	1	Hanover	2	Pepperell	1
Adams	3	Hartford, Conn.	1	Pittsfield	3
Agawam	2	Haverhill	1	Putney, Vt.	1
Amherst	9	Hinsdale	1	Quincy	1
Andover	3	Hohokus, N. J.	1	Reading	1
Arlington	1	Holbrook	1	Red Bank, N. J.	1
Ashland	1	Holyoke	13	Revere	2
Athol	1	Hubbardston	1	Richmond	1
Attleboro	1	Ipswich	1	Rockport	1
Baldwin, N. Y.	1	Island Pond, Vt.	1	Russell	1
Barnstable	3	Lancaster	1	Seymour, Conn.	1
Belchertown	1	Lanesborough	1	Sheffield	3
Belmont	1	Lawrence	2	Shrewsbury	1
Berlin	1	Lee	1	Somerset	1
Bloomfield, Conn.	1	Lincoln	1	Somerville	1
Boston	13	Lynn	3	Southborough	1
Braintree	1	Malden	3	Southbridge	2
Brewster	1	Maynard	2	South Hadley	1
Bridgewater	1	Medford	2	Springfield	10
Chelsea	1	Medway	1	Stoneham	4
Chicopee	1	Melrose	1	Sudbury	2
Colrain	3	Mendon	1	Summit, N. J.	1
Cummington	2	Methuen	1	Swampscott	1
Dalton	1	Mexico City, Mex.	1	Taunton	1
Deerfield	3	Middleborough	1	Wakefield	2
Dover	1	Milford	1	Walpole	1
Dudley	1	Millis	1	Waltham	2
Duxbury	1	Monson	1	Ware	1
East Bridgewater	1	Montague	4	West Bridgewater	1
Easthampton	4	Montpelier, Vt.	1	Westfield	2
Easton	1	Mt. Lakes, N. J.	1	Westford	1
Englewood, N. J.	1	Needham	3	West Newbury	1
Everett	2	New Bedford	1	Westport	1
Falmouth	1	Newburyport	1	West Rutland, Vt.	1
Framingham	2	Newton	2	West Springfield	2
Gloucester	3	North Adams	3	West Stockbridge	1
Goshen	1	Northampton	3	Wilbraham	1
Great Neck, N. Y.	1	Oakham	1	Williamsburg	2
Granby	1	Orange	2	Windsor, Conn.	2
Greenfield	8	Oslo, Norway	1	Winthrop	1
Groton	1	Otis	1	Worcester	10
Hadley	2	Palmer	1	Worthington	1
Halifax	1				

B. Home Addresses (classified by States and Countries)

	Number	Per Cent		Number	Per Cent
Connecticut	5	2.09	New York	2	.84
Massachusetts	221	92.47	Norway	1	.42
Mexico	1	.42	Vermont	4	1.67
New Jersey	5	2.09		239	100.00

C. Home Addresses (classified by Counties of Massachusetts)

	Number	Per Cent		Number	Per Cent
Barnstable	5	2.26	Hampshire	28	12.67
Berkshire	19	8.60	Middlesex	34	15.39
Bristol	6	2.71	Norfolk	10	4.52
Essex	18	8.14	Plymouth	8	3.62
Franklin	20	9.05	Suffolk	17	7.69
Hampden	34	15.39	Worcester	22	9.96
				221	100.00

D. Nativity of Parents

	Number	Per Cent
Neither parent foreign born	156	65.27
Both parents foreign born	53	22.18
Father (only) foreign born	19	7.95
Mother (only) foreign born	11	4.60
	239	100.00

E. Education of Father

	Number	Per Cent
Common School	81	33.89
High School	80	33.47
Business College	19	7.95
College or University	42	17.57
No statistics	17	7.12
	239	100.00

F. Occupation of Father

	Number	Per Cent
Agriculture and Horticulture	40	16.74
Artisans	57	23.85
Business	78	32.64
Professional	30	12.55
Miscellaneous	13	5.44
Retired	1	.42
Deceased	12	5.02
No statistics	8	3.34
	239	100.00

G. *Intended Vocation of Students*

	Men	Women	Total	Per Cent
1. *Farming*, including Market Gardening, Nursery business, Florist's business, Fruit Growing, Management of Estates, General Farming, Poultry Husbandry, Livestock Breeding, etc.	26	1	27	11.30
2. *Agricultural Business*, including sales of agricultural products and other capacities such as the fertilizer industry, the feed industry, etc.	1	–	1	.42
3. *Science*, including Chemistry, Botany, Entomology, Bacteriology, etc., in such capacities as research experts, laboratory assistants, technologists	49	8	57	23.85
4. *Landscape Architects* and Agricultural Engineers	22	3	25	10.42
5. *Teachers*, including College Professors, High School Instructors, Specialists in Extension Education, etc.	20	15	35	14.65
6. *Professional Practitioners*, including Physicians, Surgeons, Dentists, Lawyers, Veterinarians, Ministers, etc.	23	–	23	9.62
7. *Civil Engineers*	–	–	–	–
8. *Industrial Enterprises*, including Manufacturing, Merchandising, Advertising, Banking, Accounting, Real Estate, Insurance, etc.	2	–	2	.84
9. Authors, Artists, Journalists, etc.	–	–	–	–
10. Home Economics	–	15	15	6.28
11. Miscellaneous	4	2	6	2.52
12. Undecided	31	17	48	20.10
	178	61	239	100.00

H. *Farm Experience*

	Men	Women	Total	Per Cent
Brought up on a farm	37	11	48	20.08
Not brought up on a farm and having no or practically no farm experience	125	44	169	70.71
Not brought up on a farm but having had some farm experience	16	6	22	9.21
	178	61	239	100.00

I. *Miscellaneous Statistics*

Average age (years)	18.71

THE COLLEGE CATALOGUE

This issue of The Bulletin contains the catalogue of the College for the sessions of 1930–31 which is part of the Sixty-Eighth Annual Report of the Massachusetts Agricultural College and as such is part II of Public Document 31. (Sec. 8, Chapter 75 of the General Laws of Massachusetts.)

6m—8-'30. No. 9881.

Publication of this Document approved by the Commission on Administration and Finance

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Legislation Pertaining to the College.

Without excluding other scientific and classical studies, and including military tactics, to teach such branches of learning as are related to agriculture and mechanic arts in such manner as the legislatures of the states may respectively prescribe, in order to promote the liberal and practical education of the industrial classes in the several pursuits and professions of life. — *Act of Congress, July 2, 1862.*

The College Charter. — "The leading object of the college shall be to teach subjects relating to agriculture and the mechanic arts, so as to promote liberal and practical education. Its curriculum may include other scientific and classical studies and shall include military tactics." — *From Chapter 75 of the General Laws of Massachusetts.*

This issue of the catalogue represents the status of the college for the current college year, with provisional announcement of courses of study and other matters for the year to follow. When deemed necessary, additional announcements are made in a supplementary bulletin, published in the spring.

The college reserves, for itself and its departments, the right to withdraw or change the announcements made in its catalogue.

CALENDAR.

1930.

September 17–20, Wednesday–Saturday	Entrance Examinations
September 22, Monday	Fall term begins for Freshmen
September 24, Wednesday	Fall term begins for all except Freshmen
October 13, Monday	Holiday, Observance of Columbus Day
November 11, Tuesday	Holiday, Armistice Day
November 26–December 1, Wednesday, 12 M.–Monday, 7.30 A.M.	Thanksgiving Recess
December 20, Saturday, 6 P.M.	Fall term ends

1931.

January 5, Monday, 7.30 A.M.	Winter term begins
February 23, Monday	Holiday, Observance of Washington's Birthday
March 21, Saturday, 6 P.M.	Winter term ends
March 30, Monday, 7.30 A.M.	Spring term begins
April 20, Monday	Holiday, Observance of Patriots' Day
May 30, Saturday	Holiday, Memorial Day
June 5–8, Friday–Monday	Stockbridge School Commencement
June 12–15, Friday–Monday	Commencement
June 18–20, Thursday–Saturday	Entrance Examinations
June 29–August 8	Summer School
September 16–19, Wednesday–Saturday	Entrance Examinations
September 21, Monday	Fall term begins for Freshmen
September 23, Wednesday	Fall term begins for all except Freshmen
September 30, Wednesday	Fall term begins for Stockbridge School
October 12, Monday	Holiday, Columbus Day
November 11, Wednesday	Holiday, Armistice Day
November 25–30, Wednesday, 12 M.–Monday, 7.30 A.M.	Thanksgiving Recess
December 19, Saturday, 6 P.M.	Fall term ends

1932.

January 4, Monday, 7.30 A.M.	Winter term begins

THE TRUSTEES.

Organization of 1930.

Members of the Board.

	Term expires
Frank Gerrett of Greenfield	1931
Harold L. Frost of Arlington	1931
Charles H. Preston of Danvers	1932
Carlton D. Richardson of West Brookfield	1932
Davis R. Dewey of Cambridge	1933
John F. Gannon of Pittsfield	1933
George H. Ellis of West Newton	1934
Philip F. Whitmore of Sunderland	1934
John Chandler of Sterling Junction	1935
Frederick D. Griggs of Springfield	1935
Nathaniel I. Bowditch of Framingham	1936
Howard S. Russell of Waltham	1936
Sarah Louise Arnold of Lincoln	1937
James F. Bacon of Boston	1937

Members Ex Officio.

His Excellency Governor Frank G. Allen of Boston, *President of the Board of Trustees.*
Roscoe W. Thatcher, *President of the College.*
Payson Smith, *State Commissioner of Education.*
Arthur W. Gilbert, *State Commissioner of Agriculture.*

Officers of the Trustees.

His Excellency Governor Frank G. Allen of Boston, *President.*
George H. Ellis of West Newton, *Vice-President.*
Robert D. Hawley of Amherst, *Secretary.*
Fred C. Kenney of Amherst, *Treasurer.*
Frank Gerrett of Greenfield, *Auditor.*

Standing Committees of the Trustees.[1]

Committee on Finance.

Frank Gerrett, *Chairman.*
Nathaniel I. Bowditch.
George H. Ellis.
John Chandler.
Harold L. Frost.
Davis R. Dewey.
Charles H. Preston.

Committee on Faculty and Program of Study.

Davis R. Dewey, *Chairman.*
James F. Bacon.
Payson Smith.
John Chandler.
John F. Gannon.
Arthur W. Gilbert.
Miss Sarah Louise Arnold.

[1] The President of the College is ex-officio member of each committee.

Committee on Agriculture.

Nathaniel I. Bowditch, *Chairman.*
Carlton D. Richardson.
Frank Gerrett.
Arthur W. Gilbert.
George H. Ellis.

Committee on Horticulture.

Harold L. Frost, *Chairman.*
Howard S. Russell.
John Chandler.
Philip F. Whitmore.
Charles H. Preston.

Committee on Experiment Station.

Charles H. Preston, *Chairman.*
Arthur W. Gilbert.
Howard S. Russell.
Harold L. Frost.
Carlton D. Richardson.
Philip F. Whitmore.

Committee on Buildings and Grounds.

George H. Ellis, *Chairman.*
Frank Gerrett.
Carlton D. Richardson.
James F. Bacon.
Charles H. Preston.
Philip F. Whitmore.

Committee on Extension Service.

John Chandler, *Chairman.*
Nathaniel I. Bowditch.
Frederick D. Griggs.
Davis R. Dewey.
John F. Gannon.
Arthur W. Gilbert.
Miss Sarah Louise Arnold

OFFICERS OF THE INSTITUTION

As of November 1, 1930.

Officers of Administration.

ROSCOE W. THATCHER, D.Agr., LL.D. President's House
President.
WILLIAM L. MACHMER, A.M. 25 Amity Street
Dean.
FRED C. KENNEY Mount Pleasant
Treasurer.
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Director of the Experiment Station and Director of the Graduate School.
ROLAND H. VERBECK, B.S. 14 Orchard Street
Director of Short Courses.
WILLARD A. MUNSON, B.S. 101 Butterfield Terrace
Director of Extension Service.
ROBERT D. HAWLEY, B.S. South Amherst
Secretary.
BASIL B. WOOD, A.B. 11 South Prospect Street
Librarian.
GEORGE E. EMERY, B.S. 88 Pleasant Street
Field Agent.

The Resident Teaching Staff.

(The names of the faculty are arranged in groups according to rank and in sequence according to seniority of service in the institution.)

PROFESSORS.

ROSCOE W. THATCHER, D.Agr., LL.D. President's House
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INSTRUCTORS.

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JOHN B. NEWLON North Amherst
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Instructor in Agricultural Economics.
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1930-1931.

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Massachusetts Agricultural Review.

Director Munson
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Professor Cance
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Professor Welles
Professor Rice

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Professor Mackimmie
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Professor Gore
Professor Gunness
Asst. Professor Harrison
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Professor Glick
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Asst. Professor Serex

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Professor Radcliffe
Professor Lentz
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Professor Thayer
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Dean Machmer
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Athletic Board.

Dean Machmer
Professor Gore
Asst. Professor Markuson

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Professor Gunness
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Professor Sanctuary
Asst. Professor Cubbon
Asst. Professor Barrett

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Asst. Professor Tucker

Social Sciences.

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Professor Cance
Professor Patterson
Professor Welles
Asst. Professor Cutler

Horticulture.

Professor Waugh
Professor Chenoweth
Professor Thompson
Professor Thayer
Asst. Professor Harrison
Asst. Professor Snyder
Asst. Professor French

Physical and Biological Sciences.

Professor Gordon
Professor Ostrander
Professor Alexander
Professor Osmun
Professor Peters
Professor Gage
Professor Lentz
Professor Powers

GENERAL INFORMATION.

HISTORICAL SKETCH.

One of the outstanding achievements of the middle of the nineteenth century was the remarkable development in the field of science. This, in turn, brought about great changes in industry, transportation and agriculture and stimulated the desire for new information and further training. People were enthusiastic about the possibilities of the future. It is not surprising, therefore, that scientific courses gradually found their way into the academies and colleges. This was not without opposition from the friends of the old classical training, however. In many instances institutions founded along literary and philosophical lines did not favor the introduction of courses based on the needs of students desiring to perfect themselves in the technical principles and practice of the arts and industry. The demand for such courses increased, nevertheless. It was evident that the old order of education was changing but at the time the new was not apparent. It was under the above conditions that the Massachusetts Agricultural College had its birth.

The Morrill Act.

This demand for technical education finally crystallized into a bill known as the Morrill Act of 1862, endowing colleges for this purpose in every state of the Union. The original bill was framed by Senator Justin L. Morrill of Vermont and its final enactment obtained under his leadership. It provided that public land be assigned to the several states and territories, the funds from the sale of which were to be used to establish and maintain colleges of agriculture and mechanic arts. Although the main objective of such colleges was training in Agriculture and Mechanic Arts, they were to include other scientific and classical subjects in order to promote both the liberal and practical education of the industrial classes.

Massachusetts accepted the provisions of the Morrill Act in 1863 and immediately began to plan for a new college. The Massachusetts Institute of Technology was already organized, however, so it was decided that instruction in mechanic arts should be given there. For this reason the college, when founded, was one of agriculture only and today has the unique distinction of being the only separate agricultural college in the country. The General Court required that $75,000 be raised and presented to the Trustees by that town in which the college was to be located. Northampton, Lexington, Springfield and Amherst offered to comply with this request. After much discussion, Amherst was finally selected as the location and a tract of land containing 310 acres purchased for the college.

Founding and Early Growth of the College.

The institution was formally opened to students October 2, 1867. At that time there were four teachers on the faculty and four wooden buildings on the campus. The number of students steadily increased during the first term and by December 47 had been admitted. Of these members of the pioneer class of 1871 several are still alive. These men have seen the whole development of education in scientific agriculture for, at the time of their entrance into the college, technical training in this field was merely an idea, not yet even in the experimental stage. From this rather modest beginning, the college has grown steadily, not only in the field of resident instruction, but in that of research and in extension. In a sense, experimental work is as old as the institution, for during its earliest years some very important investigations were carried on by the instructors. Research work was established as a separate unit, however, in 1882 when the state provided for the establishment of an agricultural experiment station. This station which was

located at the college, was supplemented in 1887 by another, the Hatch Experiment Station, provided for under the Act of Congress establishing an experiment station in connection with agricultural colleges. These two stations were combined in 1895 and are now known as the Massachusetts Agricultural Experiment Station.

The scope of the college was further broadened with the establishment of the Extension Service. This aimed to make available to residents of Massachusetts useful and practical information in agricultural and home economics. It now serves those who are unable to take resident instruction in Amherst.

Present Scope of the College.

Thus, at the present, the college fulfills the three-fold purpose of instruction, research, and extension work.

The resident instruction in agriculture covers this field in its broadest sense. The college curriculum as now organized permits one to specialize in one of five fields, Agriculture, Home Economics, Horticulture, Physical and Biological Science, and Social Science. At the same time the student must pursue certain courses in each of the other groups so that his education becomes truly "both liberal and practical."

For those who have neither the preparation, the time or desire to pursue a collegiate course leading to a degree there are provided certain non-collegiate courses in practical agriculture. The Stockbridge School of Agriculture, located on the campus, offers a two-year course in practical agriculture. In addition there is a winter school course and a vocational poultry course.

In addition to this resident teaching there is the research work which attempts to accumulate new information in the broad field of agriculture and home economics. This information in turn is disseminated about the state to those unable to receive it through resident instruction, through the medium of the Extension Service.

THE COLLEGE CAMPUS.

Hand in hand with this steady growth of the College, there has come a marked expansion in physical equipment. The original farm of 1867, with its run-down fields and degenerated apple orchards cut up here and there by old Virginia rail fences and hedge rows has metamorphosed during the last fifty years into one of the most attractive college campuses in New England. A brief statement of land, buildings and equipment will show to what extent the original four wooden buildings have been out-grown.

Location and Lands.

The Agricultural College is located in Amherst, a town of about six thousand people, overlooking one of the most picturesque sections of the Connecticut Valley. From the standpoint of teaching material in the field of science and agriculture, the location is ideal. Amherst is ninety-seven miles from Boston and may be reached by the Central Massachusetts division of the Boston & Maine Railroad, or by the Central Vermont Railroad. Electric cars also connect the town with Northampton, Holyoke, and Springfield. The campus consists of a tract of approximately seven hundred acres, lying about a mile north of the village center. In addition the college owns another area of seven hundred and fifty-five acres located about six miles north of the campus on Mount Toby. This is used for a demonstration forest.

Buildings and Equipment.

The campus is laid out in the form of an oval attractively set off by the college pond in the center. Around this oval are grouped the main buildings of the college. In the following list the buildings are presented in order about this oval.

South College. — Here are located the administrative offices, including the office of the President, Dean, Treasurer, Secretary, the Extension Service, Short Courses, and Women's Adviser. The Department of Agricultural Economics also has offices here. The west wing is used as a freshman dormitory. This accommodates about forty students. Erected 1885.

North College. — This has been recently remodelled as a freshman dormitory accommodating about seventy-five men students. A large living room serves as the center of freshman social life on the campus. North College was erected in 1867.

Flint Laboratory. — The work in Dairy Manufactures is carried on here. The building is well equipped with modern machinery for the production of market milk, ice-cream, butter and cheese. This building was erected in 1911 and was named in honor of Charles L. Flint, fourth president of the college.

Stockbridge Hall. — Here are located the departments of Agronomy, Animal Husbandry, Agricultural Engineering, Farm Management, Poultry Husbandry, Education and English. In addition to the lecture rooms and offices are laboratories for soil fertility, field crops, poultry, and a drafting room for engineering. The clothing and house furnishing laboratories for the Home Economics Department are also located here. In the rear of the building are the greenhouse and head house used by the Department of Agronomy for work on crops and soils. A special reference library for the Division of Agriculture is on the second floor. Bowker Auditorium, the largest auditorium on the campus, is also in this building. It has a seating capacity of nine hundred and is named in honor of William H. Bowker, a member of the first graduating class, later a Trustee of the College, and one of the pioneers in the fertilizer industry. Stockbridge Hall was erected in 1914 and named in honor of Levi Stockbridge, a former president and professor of Agriculture in the college.

Horticultural Manufactures Laboratory. — Erected in 1929. Both research and instructional work in food preservation is carried on here. The laboratories are well equipped with modern apparatus used in this rapidly developing field.

Grinnell Arena. — Such work in Animal Husbandry as pertains to livestock judging and study is carried on in the Grinnell Arena. This building erected in 1910, is located near the livestock barns and is especially designed for judging work.

Agricultural Engineering Laboratory. — Included in this laboratory for students of Rural Engineering, located a short distance back of Stockbridge Hall, are a carpenter shop, general repair shop, and a laboratory for farm machinery and motors. The building was erected from 1916 to 1924.

Draper Hall. — The college dining hall is located in Draper. The main dining room has a seating capacity of three hundred and seventy. In addition there is a cafeteria in the west wing which can accommodate about ninety-five at one time. The capacity of the dining hall during a normal meal hour is about six hundred although as many as one thousand can be accommodated. There is a small banquet room on the second floor and several dormitory rooms. Erected 1902 and subsequently, and named in honor of James Draper, for twenty years a trustee of the college.

Goessmann Laboratory. — This is a modern chemical laboratory. The building is approximately two hundred feet by eighty feet and contains eight large laboratory rooms, a large auditorium, a chemical library, and lecture rooms. The east wing of the third floor is occupied by the research professors in Chemistry of the Experiment Station. In addition to the work in Chemistry the class work in German is held in this building. Goessmann Laboratory was erected in 1924 and named in honor of Charles A. Goessmann, the first professor of Chemistry at the college.

West Experiment Station. — The state control work is centralized here. Fertilizers, seeds, and feeds are analyzed or inspected in accordance with the state law, to determine whether or not they meet their guarantee. Erected 1886.

East Experiment Station. — The office of the Director of the Experiment Station and other administrative offices of the Experiment Station are located in this building.

Abigail Adams House. — This is a modern girls' dormitory accommodating about one hundred students. It was erected in 1919 and named for Abigail Adams, a staunch believer in farm life, the wife of John Adams, second President of the United States. In the rear of the building is a large athletic field used in connection with the physical training of the women students.

The Homestead. — Girls majoring in Home Economics receive their Home

Management practice in the Homestead. It is a remodelled colonial farmhouse newly equipped with all the modern conveniences of the home.

Bacteriology and Physiology Laboratory. — This building, erected in 1915, is especially designed to carry on work in Bacteriology as it relates to soil, industry, dairying, foods and public health. There are four class laboratories, several private laboratory rooms and offices and a lecture room. In addition there are incubator rooms, sterilizing rooms, hood rooms, washing rooms, inoculating rooms, weighing rooms, an animal room, a photographic and dark room, and a sub-basement refrigerator room. There is also a well-equipped library containing books and current periodicals useful in the conduct of bacteriological and physiological work and investigation.

Infirmary. — The Infirmary consists of two small cottages on the hillside in the rear of the Bacteriology Laboratory. They are especially designed to care for sick or injured students. A trained nurse is on duty at all times to assist in the needs of the patient.

Physics Building. — This is a small wooden building erected in 1867. It contains a well-equipped laboratory for work in college Physics and also one lecture room.

Wilder Hall. — Here are located the departments for Landscape Gardening and Pomology. The building is chiefly devoted to classrooms, drafting rooms, and offices. It was erected in 1905 and named in honor of Marshall P. Wilder, a pioneer in the movement for agricultural education in Massachusetts and one of the first Trustees of the college.

Fisher Laboratory. — This is a well planned and equipped fruit packing and storage house. It includes six refrigerator rooms, four storage rooms not refrigerated, one large laboratory room, one class room besides ample storage space for fruit packages and equipment. The equipment for the building itself includes four types of apple sizers, packing tables and box and barrel presses of various types, besides all kinds of packages with smaller equipment necessary for thoroughly modern work in grading and packing fruit. This building is used by the Pomology Department and was named in honor of Jabez Fisher, one of the foremost, early horticulturists of the State. Erected 1910. Just east of Fisher Laboratory is the Horticultural Manufactures shed containing equipment for making cider, vinegar, and maple syrup.

French Hall. — French Hall houses the departments of Floriculture, Forestry, Horticulture and Vegetable Gardening. It is also the headquarters of the Northeastern Forest Experiment Station. The classroom work in Economics, Sociology, French and Spanish is also given here. Just to the rear of the building is the new Durfee range of greenhouses, devoted to the growing of carnations, roses, chrysanthemums, violets, etc. One house is maintained as a conservatory and contains a collection of plants used primarily for decorative purposes. Another house is devoted to greenhouse vegetables. The old Durfee range located just to the north of French Hall is used chiefly for the growing and maintenance of a collection of conservatory plants. There are also many of economic value such as the bamboo, camphor tree, guava, palm, etc. French Hall was erected in two sections; the first in 1908, the second in 1913. It was named in honor of Henry S. French, the first president of the college.

Clark Hall. — Here are located the offices, lecture rooms and laboratories of the Department of Botany. In addition to the main building, there is a greenhouse used for research and laboratory purposes. The herbarium contains about twenty thousand sheets of seed plants and ferns, twelve hundred sheets of liverworts and mosses and a collection of twenty-five thousand specimens of fungi. The office and laboratory of plant pathology of the Northeastern Forest Experiment Station also are located in this building. Erected in 1906 and named in honor of William S. Clark, president of the college and professor of Botany from 1867 to 1879.

Fernald Hall. — This building, erected in 1909, was named in honor of Professor Charles H. Fernald, who served the college for twenty-four years, built up a strong department in Zoölogy, created the department of Entomology, and acted as Director of the Graduate School. Fernald Hall houses the Departments of Zoölogy, Geology, and Entomology. In addition to laboratories, lecture rooms,

and offices, there is a Geological Museum, a Zoölogical Museum and a collection of over 160,000 insects. Material in these collections is available for study and for exhibition purposes. In the basement is located the cooking laboratory of the department of Home Economics.

Mathematics Building. — This is a small frame building containing classrooms for instruction in mathematics and surveying. There is also a well equipped drafting room, and a small one devoted to blue-printing.

Paige Laboratory. — The work in Veterinary Science is located in this building. In addition to the class, lecture, and laboratory rooms, there are the laboratories for the State Control and Research work on animal diseases. The museum contains a growing number of anatomical and pathological specimens, most of which are used for teaching purposes. In the rear of the building are the stables for housing both laboratory and larger animals under isolation conditions for dissection, post mortem examinations and for incineration purposes. Paige Laboratory was erected in 1898 and named for James B. Paige, Professor of Veterinary Science from 1891 to 1922.

Drill Hall. — Here are located the offices of the Military and Physical Education Departments. Included is a basket ball floor, shower baths, lockers, and an indoor rifle range.

Physical Education Building. — This building will be completed in 1931 and will afford modern equipment for physical education, including a seventy-five foot swimming pool, an exercise hall one hundred and fifty feet by one hundred and eighty feet, lockers, baths and other modern indoor facilities. The building has been made possible by the generosity of alumni and friends of the College, and to these gifts the state government added funds sufficient to erect the building.

Alumni Field. — This tract of land was transformed into an Athletic Field, containing a baseball diamond, football field, and cinder track, by the Alumni and friends of the college. Completed 1915.

Memorial Hall. — The social center of student life is Memorial Hall. It was erected by the Alumni, students, faculty and friends of the college in memory of those M. A. C. heroes who died in the World War. In the basement are bowling alleys, pool tables, a store, post office and barber shop. On the main floor are eight offices for the leaders of various student activities, a large reading room and a beautiful Memorial Room in which is found a tablet bearing the names of the sons of the college who gave their lives in the Great War. On the second floor is an auditorium seating 350 persons. This room is also used for college dances. Memorial Hall was erected in 1921.

Library. — This was originally the college chapel. It now contains one of the best agricultural libraries in the country. There are about 85,000 bound books together with a greater number of unbound books, pamphlets, magazines, etc. The collection covers the general field of agriculture, science, literature, history and sociology. The periodical file contains over 600 magazines and newspapers. The library is open during terms from 8 A.M. to 10 P.M. daily and from 1.30 to 4.30 and 7 to 9 P.M. Sundays, with shorter hours during vacation. This building was erected in 1885.

Power Plant. — Heat and light are supplied to all the buildings on the campus from a central power plant. This was erected in 1902 and has been subsequently remodeled.

Farm Buildings, Land and Equipment.

College Farm and Barns. — The college farm consists of 240 acres located just west of South College. Most of it is suitable for cultivation and is operated in regular rotation. Much of the farm as it now stands has been made productive by tile draining and clearing the land of brush and stumps. The principal crops raised are those which can be utilized by the livestock, together with some cash crops such as cabbage, carrots, potatoes, and hay. For instructional work the farm is available for study in field crops, planning of crop rotation, practical field operation of farm machinery and tractors and farm management. The livestock of the farm consists of about 165 head of registered cattle which are excellent representatives of the Ayrshire, Guernsey, Holstein, Jersey, Milking Shorthorns, and Hereford breeds, a considerable number of registered Berkshire

and Chester White swine, a flock of about 100 Shropshire and Southdown sheep and 20 Percheron horses. These animals are used chiefly for demonstrational and instructional work in feeding and herd management and in the teaching of correct types by much practice in judging. The farm buildings are model structures for their various purposes. They were erected in 1909 and subsequently. The dairy barns contain efficient and modern equipment for their respective purposes. The sheep barns and piggery are located several hundred yards down from the dairy barns.

Cavalry Stable. — This stable has a capacity for the sixty horses which are used by the M. A. C. Cavalry troop. This building is maintained by Federal expense. Erected in 1925.

Poultry Plant. — The college poultry plant consists of about twenty acres of land in addition to the various buildings that go to make up a modern poultry plant. Although only eight acres of the land comprising the plant are college-owned this quantity permits for a three-year growing rotation. The plant will accommodate 2,000 laying birds and has growing facilities for about 7,000 chicks. The incubator capacity of the plant is approximately 12,000 eggs at one time. Located about one-half mile east of the college on East Pleasant Street, is the experimental poultry farm which accommodates about 1,200 adult birds and has hatching facilities for about 3,000 chicks. Here experiments on breeding poultry for egg production and disease control are carried on under strict quarantine.

The Hatch Barns. — These structures house the live stock which have been segregated from the main herd and flocks for the purpose of experimentation work in connection with the subject of feed and feeding. Erected in 1891.

Experiment Station Barns. — These buildings contain the equipment and animals used in connection with the work of the Massachusetts Experiment Station.

Orchards and Vineyards. — The college orchard contains about 20 varieties of peaches, 25 of plums, 20 of pears, and 100 of apples. Common varieties of grapes are grown in the vineyards and with the various approved trellis systems. These orchards are used for teaching material in Pomology.

Vegetable Gardens. — Here are grown the class material used by the vegetable gardening department.

Mt. Toby Demonstration Forest. — This is an area of approximately 750 acres located on Mt. Toby. It contains the various types of forest growth found throughout the State. It serves as a field laboratory in forestry. Students have the privilege of working out problems in silviculture, forest mensuration and management. Improvement cuttings, cuttings for utilization and forest planning are conducted here also.

COURSES OF INSTRUCTION.

Collegiate Courses.

Four-Year Collegiate Course. — The degree of Bachelor of Science is granted to those students satisfactorily completing the four years' work of collegiate grade.

The field of instruction covers Agriculture, Home Economics, Horticulture, Physical and Biological Sciences and Social Science.

Graduate School. — Students with the necessary qualifications may register in the Graduate School. The degrees of Master of Science, Master of Agriculture, Master of Landscape Architecture, Doctor of Philosophy, and Doctor of Agriculture may be granted upon the completion of satisfactory study, research, and a thesis.

Summer School. — Both graduate and undergraduate courses are offered in the six weeks' summer school. Only courses of collegiate grade are offered. Credits earned may count toward the Bachelor of Science degree or advanced degrees.

Non-Collegiate Courses.

Several short courses of non-collegiate grade are offered to meet the needs of those both young and old who through lack of preparation cannot qualify for the college course, or who desire only practical training in the modern accepted

methods of farming. These courses are planned to help the farmer and the housewife.

Stockbridge School of Agriculture. — The purpose of this school is to provide a two-year course in practical agriculture for those who cannot meet the entrance requirements of a college course or who for other reasons cannot enroll for collegiate work. Study in this school is not equivalent to study in the college. Subjects taken in the Stockbridge School of Agriculture cannot be used for college credit.

The Winter School. — Beginning about January first a ten weeks' winter school is given. Practical courses in agriculture and horticulture are offered and are so arranged that a student may choose such subjects as will enable him to specialize along the line of work in which he is most interested.

One-Year Vocational Poultry Course. — This course is designed for those who wish an intensive course preparing them for practical poultry raising.

STUDENT EXPENSES.

Matriculation Fee and Tuition.

Matriculation Fee. — All students entering the college for the first time as undergraduates, are charged a matriculation fee of $5.00 which in the event of a student leaving the institution, is returned, if all bills due the college are paid, or is, upon graduation, considered as payment for the diploma.

Tuition. — Residents of Massachusetts are charged a tuition fee of $60 per year, payable in advance in three installments of $20 each on the first day of each term. For those who are not residents of Massachusetts, the tuition fee is $180 per year. Students entering from Massachusetts are required to file with the Treasurer a statement signed by either town or city clerk, stating that the applicant's father is a legal resident of Massachusetts.

Dormitory Rooms.

All freshman students are expected to room in college dormitories unless excused by the Dean. Registration for freshman girls will be closed as soon as all available dormitory space has been assigned. Men students who cannot be accommodated in dormitories will be permitted to live in approved private homes. An application for a room cannot be filed until the student has been accepted for entrance. A $15.00 deposit, made payable to the Treasurer of M. A. C., must accompany the application. In case of withdrawal before August 20, this will be refunded. As far as is feasible, rooms will be assigned in the order in which applications for the same are received. The student will be notified as soon as the assignment is made. Dormitory rooms rent for from $27.50 to $45.50 per term.

Rooms for Men. — Dormitory accommodations are available for about one hundred and ten freshmen men in North College and South College. The rooms are furnished except for necessary bedding or linen. They are cared for by the students who occupy them. Upper class men usually obtain rooms in private dwellings located near the campus. In most cases these rent for from $2.50 to $4 per week, depending somewhat on the location, and whether or not they are single or double. Such rooms are usually furnished. Students desiring aid in obtaining off campus rooms should write to the Assistant to the Dean. The College does not secure these rooms for the student but does keep a desirable list for student aid.

Rooms for Women. — Dormitory accommodations are available for about one hundred and five women students in the Abigail Adams House. These rooms are furnished except for necessary bedding or linen and are cared for by the students occupying them.

Board.

All freshman students of the College and of Stockbridge School of Agriculture are required to board at the college dining hall. The cost for board at the dining hall is $255 per year payable as follows:

At the opening of college	$79 00
December 1	18 50
January 2	82 50
March 31	75 00

For absences of one week or more rebates at the rate of $6 per week may be granted provided the absence is authorized by the Dean, and the rebate approved by the Treasurer. No rebates will be allowed for absences of less than one week. But in case a student resides nearby and for this or any similar reason is regularly absent from the campus over week-ends, upon request of his parent or legal guardian, approved by the Dean of the College or Director of Stockbridge School, he may board in the college dining hall for a five-day week (fifteen consecutive meals beginning with Monday breakfast) at the rate of 80 per cent of those paid for a seven-day week.

Individual members of upper classes may choose to board in the college dining hall at the regular rates or in the college cafeteria, or at private dining places. But all residents in college dormitories who do not eat in the college dining hall must purchase cafeteria meal tickets amounting to $7.50 per week in advance for each term. A schedule of standard meals furnished in the cafeteria is provided and at least $7.50 worth of these meals must be purchased by each ticket holder each week. Extras at any meal must be paid for in cash when selected at the serving table.

Groups of upper class men or women may arrange for group table service in the dining hall by payment for a term in advance of the rates for board as indicated for freshmen.

Excuses from compliance with these regulations concerning board shall be made only by the Treasurer of the College, who may require a recommendation in individual cases from the Students' Health Service, if the excuse is requested for health reasons, or from the Dean if the reason has to do with the student's academic opportunities.

Other Expenses.

In addition to the above charges there are other expenses, such as laboratory fees, a military uniform deposit for those taking military drill, expenditures for books and stationery and certain class assessments and taxes levied for the maintenance of various organizations, such as the Social Union, Athletic Association, weekly publications, and so on.

Initial Payment for Freshmen.

The initial payment required of freshmen by the Treasurer's Office at the time of fall registration varies from about $100 to $150 depending on whether or not the student takes military and has a room in the dormitory.

Refunds.

A student who leaves college for any reason before a term is half completed will have refunded to him one-half the fees paid for that term; but one who leaves after a term is half over will be allowed no rebate of fees and a refund of only unused board and room charges.

Estimate of College Expenses.

The following is a summary of expenses for the year. The student should realize that these are strictly college expenses and do not include amounts for clothing, traveling, etc., expenses which vary with the individual.

Tuition: citizens of Massachusetts, $60; others, $180 per year.

	Low	Normal
Tuition (citizens of Massachusetts)	$60 00	$60 00
Matriculation fee (first year)	5 00	5 00
Room in college dormitories or in private houses	70 00	140 00
Board, $7.50 per week (College Dining Hall)	255 00	255 00
Laundry, 50 to 85 cents a week	18 00	30 00
Laboratory fees	8 00	25 00
Books, stationery and miscellaneous items	40 00	60 00
	$456 00	$575 00

Graduation Requirement.

No student will be graduated unless all bills due the college are paid on or before the Wednesday preceding the graduation exercise. If paid after that date and otherwise eligible he may graduate the following year.

STUDENT EMPLOYMENT.

The college affords opportunity for part time employment for a limited number of needy students. The number of applicants for labor far exceeds the number that the institution can fill, however, so that no guarantee can be made that a student will find employment through the college. In many instances students find outside work through their own initiative. Among the permanent college positions are several janitorships. Forty or more students are employed at the dining hall. In addition the various college departments have work from time to time. Applications for student labor should be made to the Secretary of the College. Only those students are eligible for permanent campus employment whose need has been investigated by the employment committee and who have been certified as being eligible for such employment. Very few permanent campus positions are held by freshmen. For this reason freshmen are not advised to enter the college without at least $300 to $400 in cash; or enough to carry them the major portion of the year. Although they do find odd jobs about the college or town the amount of money that can be earned is usually small. Moreover, studies require practically all of the time of the beginning student. Students with insufficient funds are advised to work a year before entering college rather than attempt to carry too heavy a study and work load while in college. Those who elect military drill at the beginning of the junior year are paid by the Federal Government at the rate of 30 cents per day while in college.

SCHOLARSHIPS.

Scholarships are awarded only to needy students of high character, whose habits of life are economical and who have maintained an average of at least 70% in their college course during the preceding year. Scholarships may also be granted to applicants for admission to the college provided they are candidates for a degree, are in need of financial assistance and are able to meet the entrance requirements in full. Complete information relative to the student's need for financial aid must be presented before any application can be acted upon. Scholarships are paid in installments at the beginning of each term in the form of a credit on the student's bill for that term. A scholarship may be discontinued at the close of any term if the scholastic record of the recipient is unsatisfactory.

Blanks for applying for a scholarship may be obtained from the Dean of the college. Applicants from the three upper classes must file at the Dean's Office before the close of the college year an account of their income and expenses for that college year together with a statement of their resources for the coming year. Prospective freshmen may file their applications at the time their entrance requirements are satisfied in full.

The following scholarships are available:

1. General scholarships:
 a. Nineteen scholarships of $60 each known as the Porter L. Newton Scholarships.
 b. One scholarship of $60 known as the Mary Robinson Scholarship.
 c. One scholarship of $60 known as the Henry Gassett Scholarship.
 d. One scholarship of $60 known as the Whiting Street Scholarship.
2. Scholarships limited to students from Berkshire County:
 a. At least ten scholarships of $60 or more, known as the Frederick G. Crane Scholarships.
3. Scholarships limited to men students of Hampshire County:
 a. Several scholarships known as the Wilbur H. H. Ward Scholarships.

The above scholarships are made available through the income of the following funds:

The Wilbur H. H. Ward Educational Trust Incorporated. — This is a gift of $100,000 from Wilbur H. H. Ward. The income is available for the assistance of needy boys first from Amherst and then from Hampshire County who attend the Massachusetts Agricultural College. This fund is administered by a Board of Trustees not connected with the college.

Frederick G. Crane Fund. — The family of the late Frederick G. Crane of Dalton has presented to the Massachusetts Agricultural College a gift of $25,000 to establish a fund in memory of Frederick G. Crane, the income therefrom to be expended by the Trustees in aid of worthy undergraduate students of limited financial resources attending the college, preference being given to residents of Berkshire County.

Porter L. Newton Fund. — This is a gift of $23,411 from the late Porter L. Newton of Waltham.

The Whiting Street Scholarship Fund. — This is a gift of $1,000 of Whiting Street of Northampton.

Mary Robinson Fund. — This is a gift of $1,000 from Miss Mary Robinson of Medford.

Gassett Scholarship Fund. — This is a gift of $1,000 from Henry Gassett of Boston.

LOANS.

Loans may be granted to needy students requiring some assistance in meeting the expenses of the college course. The student must present a properly endorsed note at the time a loan is made. Money thus loaned is at a low rate of interest until the student graduates or severs his connections with the college. Applications for a loan may be made at the Treasurer's Office.

These loans are made available through the income from the following funds:

Danforth Keyes Bangs Fund. — This is a gift of $6,000 from Louisa A. Baker of Amherst, the income of which is to be used annually in aiding poor, industrious and deserving students to obtain an education in the Massachusetts Agricultural College.

Charles A. Gleason Fund. — This is a gift of $5,000 from Charles A. Gleason of North Brookfield, Massachusetts, a trustee of the college from 1889 to his death, September 29, 1925.

Massachusetts Agricultural Club Fund. — The Massachusetts Agricultural Club has given $500 to be used as a loan fund at the Massachusetts Agricultural College to help out deserving students there who intend to go into agricultural work.

4-H Club Loan Fund for Boys. — A loan fund of $1,000.

4-H Club Loan Fund for Girls. — A loan fund of $100.

HONORS FOR SCHOLARSHIP.

Honors Groups. — At the beginning of each term a list is posted of those students who during the previous term made a general average of 80 per cent or better. Three groups are recognized: those between 90 and 100; those between 85 and 90; and those between 80 and 85. Sophomores, Juniors and Seniors in the first two groups are allowed considerable freedom in the matter of class attendance.

General Honors Course. — High ranking Seniors who have maintained an average of 80 per cent throughout the college course are given the privilege of enrolling for a general honors course given during the spring term. Some outstanding instructor on the staff of the College or some other college is chosen to teach this. Since he has a group of selected senior students he is allowed the greatest freedom in the matter of course content and method of presentation.

Departmental Honors. — A student who has shown outstanding promise within some department and has maintained a general scholastic average of 80 per cent or better is permitted to apply for the privilege of registering for departmental honors. If his application is accepted by his department and the Honors Committee, he is allowed to pursue a course of independent study within

the department of his choice throughout his senior year. This may include intensive reading, investigation or laboratory work in connection with some problem that he chooses for his consideration. The objective is to create on the part of the student initiative, the power of independent investigation and to develop in him the spirit of research. Although the student is responsible for his undertaking he is encouraged to consult with his department in regard to his work should the need arise. At the close of his study the student presents a thesis covering his investigation. In addition he may be required to appear for an oral or written examination. If by the excellence of his work he satisfies all the requirements of his department and the Honors Committee his name will appear on the commencement program as receiving honors in the field of his specialization.

Phi Kappa Phi Elections. — Those members of the senior class whose scholarship average has been 85 or above are eligible for election to the Honorary Scholarship Society of Phi Kappa Phi. Not more than 15 per cent of the class can be elected, however.

PRIZES AND AWARDS.

Prizes are offered annually in several departments for excellence in study and for other special achievements. The prizes offered in 1928 were:

The Grinnell Prizes. — Given by the Hon. William Claflin of Boston, in honor of George B. Grinnell, Esq., of New York, for excellence in theoretical and practical agriculture. The contest is open to those senior students whose records on the registrar's books show an average standing of 80 or above for the technical work taken in the Divisions of Agriculture and Horticulture during the junior and senior years. There are three prizes of $25, $15, and $10.

The Burnham Prizes. — These were made possible through the generosity of Mr. T. O. H. P. Burnham of Boston. Prizes of $15 and $10 are awarded to those students delivering the best and second best declamations in the Burnham contest. The preliminary contests are open under certain restrictions to freshmen and sophomores.

The Flint Prizes. — The Flint Oratorical Contest was established in 1881 by a gift of the late Charles S. Flint, a former trustee of the college. After his death the prizes were continued by college appropriation. Prizes of $30 and $15 are awarded as first and second prizes to those two students delivering the best orations in this contest.

The Hills Botanical Prize. — This is given through the generosity of Henry F. Hills of Amherst, for the first and second best herbaria. Competition is open to members of the senior, junior and sophomore classes. First prize $20, second prize $15.

The Allan Leon Pond Memorial Medal. — This medal is awarded for general excellence in football in memory of Allan Leon Pond of the class of 1920, who died February 26, 1920. He was a congenial companion, a devoted lover of Alma Mater, a battle-scarred, though youthful, veteran of the Great War, a fine all round athlete and a true amateur. He would rather win than lose, but he would rather play fair than win. He has been characterized as a typical "Aggie" man.

The Frederick Cornelius Eldred Memorial Athletic Prize. — From the income of a trust fund established in 1922 by the M. A. C. Alumni Athletic Association, and named in honor of Frederick Cornelius Eldred of the class of 1873 who trained and coached crews for intercollegiate races and pulled stroke oar in them —two to victory: This prize, of one hundred dollars, may be awarded at Commencement to that member of the graduating class who has represented the College in intercollegiate athletic contests for a period of not less than two years, and who has attained the highest average standing in scholarship during his course.

The Helen A. Whittier Memorial Scholarship in "Art as Applied to Living." — This scholarship of $150 is given by the Massachusetts State Federation of Women's Clubs as a memorial to Miss Helen A. Whittier, a former president of the Federation. It is awarded annually to that sophomore, junior or senior student in Home Economics whose scholarship, character, and financial need, indicate her to be most deserving.

The Betty Steinbugler Prize in English. — This prize of $10 was endowed by John L. Steinbugler, New York City, in honor of his daughter Elizabeth Steinbugler Robertson, a graduate of this College in the Class of 1929. It is awarded annually to a woman in the junior or senior class who has written the best long paper on a subject of literary investigation in a course in English during the year.

Academics Conspicuous Service Trophy. — This trophy is awarded to that student who during the past 12 months has made the most important, single contribution to the Academic Activities.

Academics Managers' Prize. — Fifty dollars in gold awarded annually to that Academics manager who fulfills his duties most efficiently.

The Southern Alumni Baseball Cup. — This cup is awarded to that member of the baseball team who contributes most to the success and reputation of the team, both in respect to skill and spirit.

Phi Kappa Phi Award for Scholarship. — Massachusetts Chapter of the Phi Kappa Phi Honorary Scholarship Society offers an award of $100 for outstanding work in scholarship. This is given to some member of the Senior class at the opening of college in the fall. The award is based on the record of the first three years.

STUDENT ACTIVITIES AND ORGANIZATIONS.

No small part of the value received from four years of college is the training that one acquires through participation in student activities. Student organizations offer excellent opportunities for leadership in a wide variety of fields.

Student Government.

The Senate. — This is a student governing council. It is composed of representatives elected from the Junior and Senior classes. Besides acting as general director of undergraduate conduct it represents the interests of the students and the student body before the Faculty.

Adelphia. — This is a senior honorary society. The members are usually chosen from those who have been prominent in college activities. The society attempts in a quiet, unassuming way to mold student life on the campus.

The Honor Council. — The Honor System prevails at this college. The foreword of the Honor System reads as follows: "We, the students of the Massachusetts Agricultural College, believe that the goal of education is character. The man of character deals fairly with himself, and with others, and would rather suffer failure than stoop to fraud. The Honor System stands for this attitude in all relations of the students with the Faculty. In expression of our belief we pledge ourselves to the support of the constitution of the Honor System." Matters pertaining to the Honor System are in direct charge of the Student Honor Council, consisting of members elected from the four classes.

The Women's Student Council. — All appropriate matters pertaining to the conduct of women students are under the control of this council. It is composed of members selected from the senior, junior, and sophomore classes by all the women students.

Academic Activities.

The College Musical Clubs include an orchestra, and a mixed chorus. These make various appearances during the year, both in Amherst and on tour.

The Dramatic Club, the Roister Doisters, presents annually a revue and two plays, one in connection with the Junior Promenade, and the other at Commencement. There is a Debating Society which conducts both class and intercollegiate debates. All academic activities are supervised by the Academic Activities Board composed of Alumni, Faculty, and students.

"The Massachusetts Collegian" is a weekly newspaper, published by the undergraduates of the college.

"The Index" is the college yearbook published by the members of the Junior class.

College Fraternities.

There are several national and local fraternities represented on the campus. Rushing rules and general matters dealing with fraternity life are in charge of the Inter-fraternity Conference. This conference awards scholarships, a baseball cup, and a relay plaque to the winners of the Inter-fraternity Contests.

Inter-Collegiate Athletics.

The College is represented in inter-collegiate athletics by teams in all the leading sports, including football, baseball, track, hockey, and basketball. General policies governing athletics are in charge of the Athletic Board, composed of Alumni, Faculty, and students.

Professional Clubs.

There are several professional clubs established in connection with the major work of the college. Included among these is an Animal Husbandry Club, Landscape Art Club, Pomology Club, Agricultural Economics Club, and Floricultural Club.

Religious Organizations.

The Young Men's Christian Association and the Young Women's Christian Association are active both on the campus and off. In addition there is a Catholic Club, and a Jewish Menorah Society. The Cosmopolitan Club has as its object the cultivation of peace and the establishment of strong international friendship.

The Social Union.

The Social Union was established in 1907. All students become members of the Union by paying a small fee. In the fall and winter months the Union gives a series of entertainments.

HEALTH PROGRAM.

Physical Examinations. — All men students entering as freshmen are required to undergo a physical examination upon arrival at college. This examination is given during matriculation week. All women students entering as freshmen are required to present a health certificate. This involves a physical examination before coming to college.

The College Infirmary. — The college endeavors to safeguard the health of the students while on the campus. A resident nurse is on duty at the Infirmary at all times. Students are urged to go to the Infirmary at any time that they are in need of the services of such a nurse or of those of a town physician. Inasmuch as the Physical Director gives special attention to all student diseases it is to be expected that the majority of the students will go to the infirmary at his suggestion. This understanding should in no way deter students from going voluntarily at any time. Students are urged to consult the Physical Director or the resident nurse immediately when signs of physical disorder appear. Severe attacks of cold or other forms of illness can usually be avoided if treatment is administered in the incipient stage. The purpose of the infirmary is to help maintain the general good health of the students, as well as to furnish a suitable place for professional attention in cases of severe illness or accident. The infirmary fee will be at the rate of $2 per day and will be charged when one or more meals are obtained at the infirmary, or when the student remains at the infirmary for one or more nights. A nominal charge will be made to out-patients for miscellaneous treatment of a minor character. In addition to the above fees, additional expenses may be charged to the patient under certain conditions. In case a special nurse is required for the proper care of an individual, the services and board of this nurse will be paid by the patient, but the nurse will be under the general supervision of the resident nurse. If a student requires medical attention by a physician he will be required to select his physician and become responsible for fees charged by the physician. Special medical supplies prescribed by a physician or nurse will be charged to the patient. Ex-

pense for personal laundry incurred by students while in the infirmary will also be charged to the individual student.

FRESHMAN REGISTRATION.

All members of the incoming freshman class are required to be in residence on the campus for the period September 21 to September 26, 1931, inclusive. This period is known as Freshman week. During this week will be given the several psychological examinations and tests required of freshmen. In addition physical examinations will be given to the men students. Such matters as pertain to schedule and section assignments will be taken care of at the same time. Lectures on student activities, college customs, and college curriculum will be given also. The object of this week is to introduce the new student into the college, so that only the minimum amount of time will be lost when the actual studies begin.

STUDENT RELATIONS.

The customary high standard of college men and women in honor, manliness, self-respect and consideration for the rights of others constitutes the standards of student deportment.

The privileges of the college may be withdrawn from any student at any time, if such action is deemed advisable.

It should be understood that the college, acting through its president or any administrative officer designated by him, distinctly reserves the right, not only to suspend or dismiss students, but also to name conditions under which students may remain in the institution. For example, if a student is not doing creditable work he may not only be disciplined but he may also be required to meet certain prescribed conditions in respect to his studies, even though under the foregoing rules his status as a student be not affected. The same provision applies equally to the matter of absences ("cuts"). According to the rules a student is allowed a certain percentage of absences from class and other exercises. This permission, which implies a privilege and not a right, may be withdrawn at any time for any cause.

Similarly, also, it applies to participation in student activities. Though this will ordinarily be governed by the rules as already laid down, yet if, in the judgment of the college authorities, a student is neglecting his work on account of these activities, the privilege of participating in them may be withdrawn for such time as is considered necessary. Moreover, it may be withdrawn as a punishment for misconduct. Prospective students or their parents may, upon application, obtain a copy of the faculty rules governing student relations to the college.

SPECIAL APPOINTMENTS AT BOSTON.

A representative of the college will be at the State House in Boston the second and fourth Thursday of each month from 1.30 to 4 o'clock in the afternoon. Any one desiring information in regard to entrance, courses, or other matters pertaining to college instruction can obtain a personal interview at that time by calling at the information office of the Department of Education. No guarantee of an interview is made, however, unless the appointment has been arranged for in advance by writing to the Dean of the College at Amherst, Massachusetts.

Admission to Collegiate Courses.

A. APPLICATION FOR ADMISSION.

Correspondence concerning admission should be addressed to the Dean's office.

Every applicant for admission to the college must be at least sixteen years old, and must present to the Dean proper testimonials of character, which, whenever possible, should come from the principal of the school at which the applicant has prepared for college. Candidates who desire to present themselves for examination in any subjects must make application to the college for such privilege at least one month before the date of the examination. Blanks for such application may be obtained by addressing the Dean of the college. All entrance credentials must be in the hands of the Dean before the applicant can matriculate.

B. MODES OF ADMISSION.

Students are admitted to the freshman class either upon certificate or upon examination. No *diploma* from a secondary school will be accepted.

Certificates. — The Massachusetts Agricultural College is affiliated with the New England College Entrance Certificate Board. Therefore certificates of admission will be accepted from schools approved by the Board. Certificates of admission will also be accepted from any Massachusetts school listed as class "A" by the State Department of Education, but not included in the approved list of the New England College Entrance Certificate Board. Principals of schools in New England who desire the certificate privilege should address the secretary of the Board, Professor Frank W. Nicolson, Wesleyan University, Middletown, Conn. Certificates from schools outside of New England may be received if those schools are on the approved list of the leading colleges of the section in which the school in question is located.

The credentials of the Board of Regents of the State of New York are accepted as satisfying the entrance requirements of this college when offered subject for subject provided the grades are satisfactory.

Certificates in order to be accepted must present in the prescribed and restrictive elective groups at least three of the necessary fourteen and one-half units. It is to be understood, however, that responsibility for certification in either elementary French, elementary German, English 1 or English 2, Latin A, Greek A or Algebra, must be assumed by one school, if the candidate has received his preparation in any one subject named above in more than one school. Subjects lacking on certificate must be made up at the time of the examinations for admission. Conditions to the amount of two units will be allowed.

Blank forms for certification — sent to principals or school superintendents only — may be obtained on application to the Dean of the college.

Special Certificate Arrangement for Students from Agricultural Schools. — Superior graduates of Vocational Schools of Agriculture in Massachusetts and Vocational Agricultural Departments in Massachusetts High Schools may be accepted for the Degree of Vocational Agriculture provided: —

(*a*) they are unqualifiedly recommended by the Vocational Division of the Department of Education as *bona fide* Vocational Graduates with superior rank; and

(*b*) that they can present at least 14½ units of certified entrance, approved as to quality and quantity by the State Department of Vocational Education.

C. EXAMINATIONS.

Entrance examinations for admission to the Massachusetts Agricultural College will be held at the following centers: —

In June Amherst, Stockbridge Hall, room 114.
Cambridge, Massachusetts Institute of Technology, Massachusetts Ave. entrance.
In September Amherst, Stockbridge Hall, room 114.

Please note that September examinations are held in Amherst only.

Schedule for Entrance Examinations June 18–20, 1931.

First Day.

8.30 A.M. Algebra.
10.30 A.M. Chemistry.
2.00 P.M. History (ancient, medieval and modern, English, United States and Civics).

Second Day.

8.30 A.M. English 1 and 2.
11.30 A.M. Botany and Biology.
2.00 P.M. Plane Geometry.
3.30 P.M. Physics.

Third Day.

8.30 A.M. French, German, Spanish, required and elective.
1.00 P.M. Latin, elementary, intermediate and advanced, and all one-half credit electives, except those already noted.

Schedule for Entrance Examinations September 16–19, 1931.

First Day.

2.15–5.00 P.M. Greek, elementary and intermediate.

Second Day.

8.30 A.M. Algebra.
10.30 A.M. Chemistry.
2.00 P.M. History (ancient, medieval and modern, English, United States and Civics).

Third Day.

8.30 A.M. English 1 and 2.
11.30 A.M. Botany and Biology.
2.00 P.M. Plane Geometry.
3.30 P.M. Physics.

Fourth Day.

8.30 A.M. French, German, Spanish, required and elective.
1.00 P.M. Latin, elementary, intermediate and advanced, and all one-half credit electives, except those already noted.

D. REQUIREMENTS FOR ADMISSION.

The requirements for admission are based on the completion of a four-year high school course or its equivalent and are stated in terms of units. A unit is the equivalent of at least four recitations a week for a school year.

Fourteen and one-half units must be offered for admission in accordance with the entrance requirements outlined below. In some instances students are allowed to enter conditioned in not more than two units.

Entrance Requirements.

1. *Prescribed.* — The following units are required: —

Algebra	1½
Plane Geometry	1
English 1 (Grammar and Composition)	2
English 2 (Literature)	1
History	1
A foreign language	2
	8½

2. *Restricted electives.* — From two to six units selected from the following subjects: —

Mathematics and Science.

Solid Geometry	½
Trigonometry	1
Biology	1
Botany	½ or 1
Chemistry	1
Geology	½
Physical Geography	½
Physics	1
Physiology	½
Zoölogy	½

History.

Ancient	1
English	1
Medieval and Modern	1
United States and Civics	1

Foreign Language.

Elementary French	2
Elementary German	2
Elementary Spanish	2
Elementary Latin	2
Elementary Greek	2
Intermediate French	1
Intermediate German	1
Intermediate Spanish	1
Intermediate Latin	1
Intermediate Greek	1
Advanced French	1
Advanced German	1
Advanced Spanish	1
Advanced Latin	1

3. *Free margin electives* — not over four units. In case fourteen and one-half units cannot be presented in the prescribed and restricted elective groups, units not to exceed four may be offered as free margin electives. Credit in the free margin will be allowed for any substantial courses (agriculture, general science and fourth year English included) not listed under the prescribed and restricted elective groups for which credit of not less than one-half unit earned in one year is given toward a secondary school diploma. Since no entrance examinations are given in these subjects they may be offered only on certificate.

E. OTHER INFORMATION ABOUT ENTRANCE.

1. If elementary algebra and plane geometry are counted as three units the total requirement for admission will be fifteen.

2. Both the credits under the prescribed and restricted elective groups must be presented either by certificate from an approved school or by examination or by a combination of both. Credit by certificate will not be accepted unless at least three units are offered.

3. Candidates are allowed to spread their entrance examinations over the three consecutive periods just previous to their entrance into college. A period means June to September of the same year.

4. Examinations for the removal of entrance conditions will be held during the first week of the second term.

5. All entrance conditions must be satisfied before a student is permitted to enter upon the work of the sophomore year.

6. The privileges of the college may be withdrawn from any student at any time if such action is deemed advisable, regardless of whether entrance was gained by certificate or examination.

7. The passing grade for an entrance examination is 60 per cent.

F. ADMISSION TO ADVANCED STANDING.

A student desiring to transfer to this college from another of recognized standing must present the following credentials: —

1. A letter of honorable dismissal from the institution with which he has been connected.

2. A statement or certificate of his entrance record.

3. A statement from the proper officer showing a complete record of his work while in attendance.

4. A marked catalogue showing the courses pursued.

5. A statement from the proper officer, giving the total number of credits required for graduation by the institution from which the applicant is transferring, and, of this total, the number that the applicant has satisfactorily completed at the time of the transfer.

The above credentials must be sent directly from the Registrar's office of the college from which the student is transferring. They should be addressed to the Dean of the Massachusetts Agricultural College. Applications will be judged wholly on their merits. The college may prescribe additional tests before accepting applicants or determining the standing to be granted them.

At least one year's work in residence is required of any student desiring to be recommended for the Bachelor of Science degree.

G. STATEMENT OF PREPARATION REQUIRED FOR ADMISSION.

Agriculture.

Entrance credit in agriculture is granted on the following basis: —

I. The Massachusetts Agricultural College accepts a maximum of four units in agriculture (except as described on page 32) from any secondary or county agricultural high school offering work in that subject, provided evidence of such work having been done is submitted on a principal's statement, as is indicated in the "free margin" group.

II. In high schools organizing agricultural club work under the supervision and rules of the junior extension service of the college, one credit is granted for each full year of work performed under the following plan: —

Work of the Winter Term. — (*a*) The study of textbooks such as are suitable for secondary school instruction in agriculture.

(*b*) Course of study: A general outline of suggested topics for study.

(*c*) Visits by a representative of the Massachusetts Agricultural College for observation, counsel and advice in regard to kind and amount of work being done in agriculture.

(*d*) Formation of an agricultural club with officers from among its own mem-

bers, meeting once a month under local supervision of someone authorized to act for the school authorities.

Work of the Spring Term. — Same in general form as winter term.

Work of Summer Term. — An approved project conforming to the rules of some one or more of the agricultural clubs of the junior extension service of the Massachusetts Agricultural College.

Work of the Fall Term. — (*a*) An exhibit of work.

(*b*) Reports and story of achievement submitted to the junior extension service of the college.

Biology.

The entrance examination in biology will cover the work outlined by the College Entrance Examination Board. This work should extend through one full year and include both laboratory and textbook study. The requirements are met by Hunter's *Civic Biology* and similar texts. A certificate stating that a satisfactory notebook has been prepared is required.

Botany.

For one unit of credit in botany, the work outlined in the statement of requirements issued by the College Entrance Examination Board, or its equivalent, will be accepted. This work should occupy one school year and include laboratory and supplementary textbook study. For one-half unit of credit, work that covers the same ground but occupies half the time required for a full unit of credit will be accepted. These requirements are met by such texts as Stevens' *Introduction to Botany* and Bergen & Davis' *Principles of Botany*. A notebook, containing neat, accurate drawings and descriptive records forms part of the requirement for either the half-unit or the one-unit credit, and this notebook must be presented by all applicants for admission upon examination in this subject. The careful preparation of an herbarium is recommended to all prospective students of this college, although the herbarium is not required.

Chemistry.

The entrance examination in chemistry will cover the work outlined by the College Entrance Examination Board as preparatory for college entrance. In general, this consists of a year of high school chemistry from any standard textbook, with laboratory work on the properties of the common elements and their simpler compounds. No particular work is prescribed. The keeping of a notebook is required.

A certificate stating that a satisfactory notebook has been kept should be submitted at the time of examination. In such a case it is not necessary to present the notebook. If the notebook is presented it must be certified.

Students who do not take chemistry in the preparatory school begin the subject in college.

Mathematics.

(*a*) *Required.* — Algebra: The four fundamental operations for rational algebraic expressions; factoring, determination of highest common factor and lowest common multiple by factoring; fractions, including complex fractions; ratio and proportion; linear equations, both numerical and literal, containing one or more unknown quantities; problems depending on linear equations; radicals, including the extraction of the square root of polynomials and numbers; exponents, including the fractional and negative; quadratic equations, both numerical and literal; simple cases of equations with one or more unknown quantities that can be solved by the methods of linear or quadratic equations; problems depending upon quadratic equations; the binomial theorem for positive integral exponents, the formulas for the *n*th term and the sum of the terms of arithmetic and geometric progressions, with applications.

Plane Geometry: The usual theorems and constructions of good textbooks, including the general properties of plane rectilinear figures; the circle and the measurement of angles; similar polygons; areas; regular polygons and the measurement of the circle; the solution of numerous original exercises, including loci problems; applications to the mensuration of lines and plane surfaces.

(*b*) *Elective.* — Solid Geometry: The usual theorems and constructions of good textbooks, including the relations of planes and lines in space; the properties and measurement of prisms, pyramids, cylinders and cones; the sphere and spherical triangle; the solution of numerous original exercises, including loci problems; applications to the mensuration of surfaces and solids.

Plane Trigonometry: A knowledge of the definitions and relations of trigonometric functions and of circular measurements and angles; proofs of the principal formulas and the application of these formulas to the transformation of the trigonometric functions; solution of trigonometric equations, the theory and use of logarithms, and the solution of right and oblique triangles.

Physics.

To satisfy the entrance requirement in physics, the equivalent of at least one unit of work is required. This work must consist of both classroom work and laboratory practice. The work covered in the classroom should be equal to that outlined in Hall & Bergen's *Textbook of Physics* or Millikan & Gale; the laboratory work should represent at least thirty-five experiments involving careful measurements, with accurate recording of each in laboratory notebook. This notebook, certified by the instructor in the subject, must be submitted by each candidate presenting himself for examination in physics; credit for passing the subject will be given on laboratory notes and on the examination submitted. Candidates entering on certificate will not be required to present notebooks, but the principal's certification must cover laboratory as well as classroom work.

Physiology.

Hough & Sedgwick's *The Human Mechanism;* Martin's *The Human Body; Briefer Course.*

Zoology, Physical Geography, Geology.

The following suggestions are made concerning preparation for admission in the subjects named above: —

For physiography, Davis' *Elementary Physical Geography;* Gilbert & Brigham's *Introduction to Physical Geography.* For zoölogy, textbooks entitled *Animals* or *Animal Studies,* by Jordan, Kellogg and Heath; Linville & Kelley's *A Textbook in General Zoölogy.* For geology, A. P. Brigham's *A Textbook of Geology* or Tar's *Elementary Geology.*

Applicants for examination in zoölogy are *required* to present certified laboratory notebooks; applicants for examination in the other subjects are *advised* to present notebooks, if laboratory work has been done. Good notebooks may be given credit for entrance. Examination in these subjects will be general in recognition of the different methods of conducting courses; but students will be examined on the basis of the most thorough secondary school courses.

History.

The required unit must be offered in either ancient history, medieval and modern history, English history, or United States history and civics. Either one, two or three elective units in any of the historical subjects here named may be offered, provided that no unit be offered in the same subject in which the required unit has been offered.

Preparation in history will be satisfactory if made in accordance with the recommendations of the committee of seven of the American Historical Association, as outlined by the College Entrance Examination Board. The examination will require comparisons and the use of judgment by the candidate rather than the mere use of memory, and it will presuppose the use of good textbooks, collateral reading and practice in written work. Geographical knowledge may be tested by requiring the location of places and movements on outline maps.

To indicate in a general way the character of the textbook work expected, the texts of the following authors are suggested: Botsford, Morey or Myers, in ancient history (to 814 A.D.); Adams, West or Myers, in medieval history; Montgomery, Larned or Cheyney, in English history; Fiske, together with MacLaughlin or Montgomery, in United States history and civics.

English.

The study of English in school has two objectives of equal importance: first, the ability to use the English language, in both speech and writing, clearly, correctly and effectively; and, second, the ability to read English literature with understanding and appreciation.

(1) *Grammar and Composition* (Two Units).—The first objective makes necessary a rigorous and reiterated instruction in grammar and composition, with special emphasis upon: spelling, sentence structure, punctuation and paragraph development. College freshmen are found deficient particularly in these fundamental phases of rhetoric.

(2) *Literature* (One Unit).—The second objective is sought by means of two lists of books, designated as *Books for Reading* and *Books for Study,* from which may be selected material for a progressive, four-year course in literature. The student should be trained to read aloud, to memorize significant passages, to associate the books with their historic background and to have well in hand both content and structure. He should be prepared for general examination on the former list and detailed examination on the latter. However accurate in subject matter, no paper will be considered satisfactory if seriously defective in punctuation, spelling or other essentials of good usage.

Lists of Books for 1930–1931.

1. Books for Reading.

From each group two selections are to be made, except that for any book in Group V a book from any other may be substituted.

Group I.

Cooper: *The Last of the Mohicans.*
Dickens: *A Tale of Two Cities.*
George Eliot: *The Mill on the Floss.*
Scott: *Ivanhoe* or *Quentin Durward.*
Stevenson: *Treasure Island* or *Kidnapped.*
Hawthorne: *The House of the Seven Gables.*

Group II.

Shakespeare: *The Merchant of Venice, Julius Caesar, King Henry V, As You Like It, The Tempest.*

Group III.

Scott: *The Lady of the Lake.*
Coleridge: *The Ancient Mariner;* and Arnold: *Sohrab and Rustum.*
A collection of representative verse, narrative and lyric.
Tennyson: *Idylls of the King* (any four).
The Æneid or *The Odyssey* in a translation of recognized excellence, with the omission, if desired, of books I–V, XV and XVI of *The Odyssey,* or the *Iliad* with the omission, if desired, of books XI, XIII, XV and XXI.
Longfellow: *Tales of a Wayside Inn.*

Group IV.

The *Old Testament* (the chief narrative episodes in Genesis, Exodus, Joshua, Judges, Samuel, Kings and Daniel, together with the books of Ruth and Esther.)
Irving: *The Sketch Book* (about 175 pages).
Addison and Steele: *The Sir Roger de Coverley Papers.*
Macaulay: *Lord Clive or History of England,* Chapter III.
Franklin: *Autobiography.*
Emerson: *Representative Men.*

Group V.

A modern novel.
A collection of short stories (about 150 pages).

A collection of scientific writings (about 150 pages).
A collection of prose writings on matters of current interest (about 150 pages).
A selection of modern plays (about 150 pages).
All selections from this group should be works of recognized excellence.

2. Books for Study.

One selection is to be made from each of groups I and II, and two from Group III.

Group I.

Shakespeare: *Macbeth, Hamlet.*

Group II.

Milton: *L'Allegro, Il Penseroso,* and either *Comus* or *Lycidas.*
Browning: *Cavalier Tunes, The Lost Leader, How They Brought the Good News from Ghent to Aix, Home Thoughts from Abroad, Home Thoughts from the Sea, Incident of the French Camp, Hervé Riel, Pheidippides, My Last Duchess, Up at a Villa — Down in the City, The Italian in England, The Patriot, The Pied Piper, De Gustibus, Instans Tyrannus, One Word More.*

Group III.

Burke: *Speech on Conciliation with America.*
Macaulay: *Life of Johnson.*
Lowell: *Democracy.*
Lincoln: *Speech at Cooper Union, his Farewell to the Citizens of Springfield, his brief addresses at Indianapolis, Albany and Trenton, the speeches in Independence Hall, the two Inaugural Addresses, the Gettysburg Speech, and his Last Public Address, together with a brief memoir or estimate of Lincoln.*
Carlyle: *Essay on Burns,* with a brief selection from Burns's poems.

FRENCH.

Elementary: The necessary preparation for this examination is stated in the description of the two-year course in elementary French recommended by the Modern Language Association, contained in the definition of requirements of the College Entrance Examination Board.

Third and fourth year French (elective subjects for admission). — For a third unit in French as an elective subject for entrance, the work heretofore described by the College Entrance Examination Board as "intermediate" is expected. For a fourth unit, the work described as "advanced" is expected.

No examination for a third unit in French will be given unless the candidate has presented elementary French on certificate, or has written the examination in elementary French.

No examination for a fourth unit in French will be given unless the candidate has presented both elementary and intermediate French upon certificate, or has written the examination in both elementary and intermediate French.

GERMAN.

Elementary: The entrance requirements in German conform to those of the College Entrance Examination Board for elementary German (the standard two-year requirements).

Third and fourth year German (elective subjects for admission). — For a third unit in German as an elective subject for entrance, when required units have been offered in German, the work heretofore described by the College Entrance Examination Board as "intermediate" is expected. For a fourth unit, the work described as "advanced" is expected.

No examination for a third unit in German will be given unless the candidate has presented elementary German upon certificate, or has written the examination in elementary German.

No examination for a fourth unit in German will be given unless the candi-

date has presented both elementary and intermediate German upon certificate, or has written the examination for both elementary and intermediate German.

Spanish.

Elementary: The necessary preparation for this examination is stated in the description of the two-year course in elementary Spanish recommended by the Modern Language Association, contained in the definition of requirements of the College Entrance Examination Board.

Third and fourth year Spanish (elective subjects for admission). — For a third unit in Spanish as an elective subject for entrance, the work heretofore described by the College Entrance Examination Board as "intermediate" is expected. For a fourth unit, the work described as "advanced" is expected.

No examination for a third unit in Spanish will be given unless the candidate has presented elementary Spanish on certificate, or has written the examination in elementary Spanish.

No examination for a fourth unit in Spanish will be given unless the candidate has presented both elementary and intermediate Spanish upon certificate, or has written the examination in both elementary and intermediate Spanish.

Greek.

Elementary — Greek grammar and composition: Translation into Greek of short sentences illustrating common principles of syntax.

The examination in grammar and prose composition will be based on the first four books of Xenophon's *Anabasis*.

Intermediate: Homer's *Iliad,* Books I and II (omitting Book II, 494 to end), and the Homeric forms, constructions, idioms and prosody.

Prose composition, consisting of continuous prose based on Xenophon, and other Attic prose of similar difficulty.

Translation of passages of Homer at sight.

The examinations in Greek, elementary and intermediate, will be given in September only.

Latin.

Elementary: Two credit units will be allowed if satisfactory proficiency is shown (including grammar) in (*a*) the translation of a passage or passages taken from Caesar's *Gallic War,* covering at least four books, and (*b*) the translation of passages of Latin prose at sight.

Intermediate: Cicero (third oration *Against Catiline* and the orations *For Archias* and *For Marcellus*) and sight translation of prose.

Advanced: Virgil (*Æneid,* II, III and VI) and sight translation of poetry.

Collegiate Course of Instruction.

The course of study consists of four years of work planned to provide scientific foundation, cultural background, and professional training, and leads to the degree of Bachelor of Science (B.S.). The following five different major lines of specialization are provided: Agriculture; Horticulture; Home Economics; the Physical and Biological Sciences; and the Social Sciences.

FRESHMAN YEAR.

The work of the freshman year consists of definitely required subjects, most of which are identical for all students, in order to insure a uniform preparation in the more fundamental collegiate subjects. However, some differentiation is required in order to properly introduce each student to some major line of work in which he may find his professional interest, and major faculty contacts. This course is presented below in tabular form.

Table of Freshman Subjects.

(Groups A and C of each term are required of all freshman men; Groups A and D of all freshmen women; and one of the options of Group B must be selected by each freshman to complete his year's program of study.)

Groups		Term I	Term II	Term III
A		Freshman Course 1	Freshman Course 2	Freshman Course 3
		Chemistry 1 or 4	Chemistry 2 or 5	Botany 3
		English 1	English 2	English 3
		Mathematics 1†	Mathematics 2†	Mathematics 3†
B	I	Leading to specialization in AGRICULTURE		
		Agronomy 1	Animal Husbandry 1	Agronomy 3
	II	Leading to specialization in HOME ECONOMICS		
		Home Economics 1	Home Economics 2	Home Economics 3
	III	Leading to specialization in HORTICULTURE AND LANDSCAPE ARCHITECTURE		
		Horticulture 1	Horticulture 2	Agronomy 3
	IV	Leading to specialization in the PHYSICAL AND BIOLOGICAL SCIENCES		
		French 1 or 4 or	French 2 or 5 or	French 3 or 6 or
		German 1 or 4	German 2 or 5	German 3 or 6
	V	Leading to specialization in the SOCIAL SCIENCES		
		French 1 or 4 or	French 2 or 5 or	French 3 or 6 or
		German 1 or 4	German 2 or 5	German 3 or 6
C		Military 1	Military 2	Military 3
		Physical Education 1		Physical Education 3
		Physical Education 2		
D		Freshman Course 4	Physical Education 5	Freshman Course 6
		Physical Education 4		Physical Education 6

SOPHOMORE YEAR.

The work of the sophomore year is also largely prescribed in order to insure as broad a cultural background as possible in preparation for the more specialized training of the last two years. Under the guidance of a major group advisory committee the student begins in this year certain optional choices of electives leading to the special courses of major work which he will later pursue. This course is presented below in tabular form.

Table of Sophomore Subjects.

(Groups A and C are required of all sophomore men; Groups A and D of all sophomore women; and two of the electives of Group B must be selected by each sophomore, with the approval of his major group advisory committee.)

† French or German is optional for Mathematics for students who intend to specialize in Home Economics.

Groups		Term I	Term II	Term III
A		English 25 English 28 Economics 25 Physics 25 or Zoology 26	English 26 English 29 Agric. Economics 26 Botany 25	English 27 English 30 History 30 Physics 27 or Physiology 33
B	I	AGRICULTURE group electives		
		Poultry Husbandry 25 Chemistry 29	Agri. Engineering 34 Chemistry 30	Dairy Industry 25 Agri. Engineering 35
	II	HOME ECONOMICS group electives		
		Home Economics 28 Drawing 30	Home Economics 32 Chemistry 30	Home Economics 40 Home Economics 46
	III	HORTICULTURE AND LANDSCAPE ARCHITECTURE group electives		
		Olericulture 25 Chemistry 29 Drawing 25	Floriculture 25 Entomology 26 Drawing 26	Pomology 25 Botany 26 Drawing 27
	IV	PHYSICAL AND BIOLOGICAL SCIENCE group electives		
		Chemistry 25 Chemistry 29 Mathematics 28 Physics 25 Zoölogy 26	Bacteriology 30 Chemistry 26 Entomology 26 Mathematics 29 Mathematics 26 Physics 26 Zoölogy 27	Botany 26 Entomology 28 Mathematics 30 Mathematics 27 Physics 27 Zoölogy 28
	V	SOCIAL SCIENCE group electives		
		French 1, 25, or 28 German 1, 25, or 28 History 28 Sociology 27	French 2, 26, or 29 German 2, 26, or 29 History 25 History 29	French 3, 27, or 30 German 3, 27, or 30 Agric. Education 29 Horticulture 27
C		Military 25 Physical Education 25	Military 26	Military 27 Physical Education 26
D		Physical Education 27	Physical Education 28	Physical Education 29

Sophomore subjects for the class of 1933 are as listed on page 41 of the catalogue for 1929–30 and as described on succeeding pages of that issue of the catalogue.

References to prerequisite courses not described in this catalogue are made to the issue of 1929–30.

JUNIOR AND SENIOR YEARS.

The work of the junior and senior years is, with certain restrictions, elective under the guidance of a special adviser, who is a member of the advisory committee of the major group which the student selects during his freshman year as his field for professional training. The aim of the last two years is to give to each student as high a degree of proficiency in some one branch of learning as is possible without sacrificing the breadth of knowledge and training which should characterize a well-rounded college course. In order to insure this result, each student is required to complete, during his last two years of study, certain requirements for specialization within his major group and certain minimum requirements in other groups:

I. Agriculture: Departments of Agricultural Engineering; Agronomy; Animal Husbandry; Dairy Industry; Farm Management; Poultry Husbandry.

II. Home Economics: Department of Home Economics.

III. Horticulture: Departments of Floriculture; Forestry; Landscape Architecture; Horticultural Manufactures; Olericulture; Pomology.

IV. Physical and Biological Sciences: Departments of Bacteriology and Physiology; Botany; Chemistry; Entomology, Zoölogy, and Geology; Mathematics and Civil Engineering; Physics; Veterinary Science.

V. Social Sciences: Departments of Agricultural Economics; Agricultural Education; Economics, History, and Sociology; Languages and Literatures.

For purpose of fulfilling the extra group requirements specified below, Groups I to III inclusive are regarded as a unit, since their work is comparable in field and character.

Specific Requirements.

Rule 1. *Credits for Graduation.* — The minimum number of credits for graduation shall be 108 junior-senior credit hours, in addition to the satisfactory completion of the required courses of the freshman year and of the required and elective groups of the sophomore year.

Rule 2. *Credits Each Term.* — Except upon special permission from the Scholarship Committee, no student shall enroll for more than 20 nor less than 16 credits each term of his junior and senior years.

Rule 3. *Specialization.* — At the close of his sophomore year each student shall designate some department within his major group in which he desires to specialize, and shall complete, during his junior and senior years, not less than 27 and not more than 54 credits in junior-senior courses offered in that department. In special cases, with the approval of the student's major adviser and the Dean, this requirement may be satisfied by the selection of at least the minimum number of credits from two or more departments of closely related work.

Rule 4. *Requirements in Other Groups.* — Each student shall complete, during his junior and senior years, not less than 9 credits in each of two groups other than his major group unit. That is, students pursuing a major in any one of Groups I to III, inclusive, must complete at least 9 credits each in Groups IV and V; students in Group IV must complete at least 9 credits each in Groups I to III, inclusive, and V; those in Group V, at least 9 credits in Groups I to III, inclusive, and IV.

Rule 5. *Credit in Military Science and Tactics.*—Not to exceed 18 Junior-Senior credits in Military Science; may be included in the minimum requirements for graduation.

Rule 6. *Advisers.* — The work of each student will be under the general supervision of his major group advisory committee from the beginning of his sophomore year, and during his junior and senior years under the immediate supervision of a special adviser who shall be some member of that committee and shall represent the department in which the student is to specialize under the terms of Rule 3. The adviser has full authority to prescribe the student's work required by Rules 3 and 4, and may advise the student with reference to his elections under Rule 7.

Rule 7. Free Electives. — Subject to the limitations imposed by Rules 2, 3, 4, and 5, each student may elect during his junior and senior years any courses offered in the catalogue for which he has the necessary prerequisite training.

Rule 8. *Registration.* — No junior or senior shall register until his course of study is approved by his adviser.

(1) A card for recording the election of courses will be issued from the Schedule Room four weeks before the beginning of the final examination period.

(2) This card must be submitted by each student to his adviser, who will lay out the course for the succeeding term and countersign the card.

(3) This card, accompanied by one hour plan, must be returned to the Schedule Room two weeks before the beginning of the final examination period.

Rule 9. *Changing of Major Group.* — Application for change of major group can be made to the Dean in writing at any time; when approved by both major group advisory committees concerned and by the Dean and the Scholarship Committee, the change becomes operative at the beginning of the term following, provided that no change in the selection of a major group may be made by any student after registration day of his senior year.

Description of Courses.

[Heavy-faced Roman numerals indicate the term in which the course is given. Numbering of courses: 1 to 24, inclusive, freshmen; 25 to 49, inclusive, sophomores; 50 to 74, inclusive, juniors; 75 to 99, inclusive, seniors.]

SPECIAL COURSES FOR FRESHMEN.

1, 2, and 3. Orientation Course. — The course will acquaint the student with the modern view of the world and man. It will present some of the main human problems of the present, especially those associated with the major work of the College. Though the subject matter is informational it will be used at times to illustrate methodology in study and thinking. The course is organized as three terms of work given as follows:

1. **I.** Man in Nature. — The main objective is to acquaint the student with his physical environment. This is accomplished by a brief discussion of topics such as the following: The earth in its relation to other astronomical bodies, its origin and growth; the physical forces operating on the earth; the nature and development of plant and animal life; the influence of all these on man. Wherever possible the subject matter is used to illustrate the methodology of study.
2 class hours. Credit, 2.
Assistant Professor Lanphear.

2. **II.** Man in Society. — The main objective is to acquaint the student with his original nature and social heritage. This is accomplished by brief discussions of instincts, habits and reflection; by a consideration of the individual with this nature in his relation to the family, the economic order, the political order, the school, church and to certain social values. A survey is also made of man's attempt to understand and control both his physical environment and himself in his own interest.
2 class hours. Credit, 2.
Assistant Professor Lanphear.

3. **III.** The Method of Science. — The main objective is to consider the nature of scientific thinking and then to use this as a method of attack in considering some of the vital problems man faces today. These problems suggest themselves as the natural outgrowth of man's increasing control over nature and himself. So far as is possible, they will be selected from the fields covered in the major work of the college.
2 class hours. Credit, 2.
Assistant Professor Lanphear.

4. **I.** College Adjustments. — For freshman women. A study of the experiences of everyday life in college, to help students recognize various social problems and to think in terms of their solution.
2 class hours. Credit, 2.
Miss Skinner.

6. **III.** Vocational Opportunities for Women. — For freshman women. An outline of the occupational progress of women, with special attention to the opportunities for women in those vocations for which the Massachusetts Agricultural College gives foundation preparation.
2 class hours. Credit, 2.
Miss Hamlin.

DIVISION OF AGRICULTURE.

Professor Rice.

Agricultural Engineering.

Professor Gunness, Assistant Professor Markuson, Assistant Professor Tague, Mr. Pushee, Mr. Newlon.

The courses in agricultural engineering are planned to give a working knowledge of those phases of engineering which apply directly to the farm. It is ex-

pected that the student will acquire a clear understanding of modern farm practice as it relates to permanent improvements of the farm and the farmstead, and in the selection and use of farm equipment.

Elective Courses.

34. **II.** Power Engineering. — For sophomores; juniors and seniors may elect. This course deals with the application of power on the farm and in the home. A study is made of the various sources of power and methods of power transmission, including electric power. Through the solution of problems, the student gets a thorough training in that branch of mechanics which deals with power and hydraulics. A study of the principles of hydraulics as they affect water supply; power from streams; pumps for domestic, dairy, and irrigation purposes.
2 class hours. 1 2-hour laboratory period, credit, 3.
Assistant Professor Tague.

35. **III.** Heat Engineering. — For sophomores; juniors and seniors may elect. The purpose of this course is to acquaint the student with the principles involved in heating, refrigeration, and heat engines. A study is made of the various types of house heating systems; the application of heat, as in cooking and pasteurization; refrigeration as applied to dairy, cold storage, and household use; and the application of electricity to cooking and lighting. The course is taught chiefly by means of problems which call for a working knowledge of the principles involved.
2 class hours. 1 2-hour laboratory period, credit, 3.
Assistant Professor Tague.

36. **III.** Mechanical Drawing and Building Construction. — For sophomores; juniors and seniors may elect. The exercises include lettering, geometric construction, orthographic projection, isometric drawing, and the making of working drawings of simple farm equipment. This course is for the agricultural student who wishes to learn the use of drawing instruments, the reading of blue prints, and some of the general practices of drafting valuable to every agriculturist. Instruction is given in building construction in order to teach the use of carpentry tools, to teach the economical use of building materials, and to give the elements involved in the framing of small structures. Students who contemplate taking Agricultural Engineering 75 will find this course helpful.
3 2-hour laboratory periods, credit, 3.
Laboratory fee, $1.00. Assistant Professor Markuson and Mr. Pushee.

50. **II.** Farm Equipment. — For juniors; seniors may elect. This course deals with the mechanical equipment of the farm, including care and repair of field implements. Practice is given in forge work, pipe fitting, soldering, and the use of machine tools. The purpose of this course is to acquaint the student with the place of up-to-date equipment on the farm and to give an appreciation of the factors involved in obtaining efficient use of this equipment.
1 class hour. 2 2-hour laboratory periods, credit, 3.
Laboratory fee, $1.00. Assistant Professor Tague and Mr. Newlon.

51. **I.** Rural Sanitary Equipment. — For juniors; seniors may elect. This course deals with the problems of providing water for farms, and means for disposal of sewage. A careful study is made of the different types of water systems and their adaptability to various conditions. The septic tank and other means of sewage disposal are studied.
2 class hours. 1 2-hour laboratory period, credit, 3.
The Department.

53. **II.** House Planning and Construction. — For juniors; seniors may elect. Plan designs of the small house will be made. The arrangement of interior equipment, especially in the kitchen, lighting, heating, water supply, and sewage disposal will be studied, together with a brief history of the house, materials,

construction methods, equipment, and architectural styles. Construction will be given to the economics of house building, including financing and to maintenance and overhead expense.

2 class hours. 2 2-hour laboratory periods, credit, 4.
Laboratory fee, $1.00. Assistant Professor MARKUSON.

75. **I.** FARM STRUCTURES. — For seniors; juniors may elect A study of the strength and durability of concrete, wood, stone, and clay products, and of the mechanical principles underlying their use in farm construction. The design of various farm buildings, such as the general purpose barn, dairy stable, hog house, sheep barn, milk house, etc. In the drafting room, details of construction will be worked out, a study of the mechanics of simple roof trusses will be made, and a complete design of some major farm building will be finished in all essential details. Blueprints of the finished design will be made.

1 class hour. 2 2-hour laboratory periods, credit, 3.
Laboratory fee, $1.00. Assistant Professor MARKUSON.

78. **I.** FARM MOTORS. — For seniors; juniors may elect. This course deals with the gasoline engine as used for stationary work, automobiles, and tractors. The theory of the internal combustion engine is taken up in order to emphasize the effect of design and operation on power and economy. The various types of carburetors, ignition, and lubrication systems are studied in detail. Instruction is given by means of lectures and textbooks, and by operating and repairing stationary engines, automobiles, and tractors. Special attention is given to overhauling and repairing.

3 2-hour laboratory periods, credit, 3.
Laboratory fee, $1.00. Assistant Professor TAGUE and Mr. PUSHEE.

79. **III.** DRAINAGE AND IRRIGATION ENGINEERING. — For seniors; juniors may elect. The course covers the engineering phase of drainage and irrigation. The various systems are studied, and practice is given in the design of drainage and irrigation systems. Field work gives practice in surveying for drains, platting, locating drains, erecting batterboards, and laying tile. Practice is given in assembling equipment for spray irrigation, and the flow of water through nozzles is studied by means of laboratory tests.

1 class hour. 2 2-hour laboratory periods, credit, 3.
Assistant Professor MARKUSON.

81. **III.** DAIRY MECHANICS. — For juniors; seniors may elect. A study of dairy machinery, including steam boilers, engines, pumps, traps, refrigeration machinery, and heat-controlling devices. Practice is given in pipe fitting, packing valves, lacing belts, and similar repair jobs on the equipment used in dairy plants.

2 class hours. 1 2-hour laboratory period, credit, 3.
Assistant Professor TAGUE and Mr. NEWLON.

82. **I.** RURAL ELECTRIFICATION. — For seniors; juniors may elect. A study of the generation and distribution of electricity for light and power. Special emphasis is placed on the utilization of electricity on the farm and in rural communities.

2 class hours. 1 2-hour laboratory period, credit, 3.
The DEPARTMENT.

83. **I, II,** and **III.** AGRICULTURAL ENGINEERING PROBLEMS. — Open to seniors only. This course consists of individual problems chosen by the students under guidance of the department. The work is of an advanced nature, supplementing that of the regular agricultural engineering curriculum. Copy of project outline, indicating the number of credits, must be filed with the department and with the Dean at the opening of the term.

Credit, 3.
The DEPARTMENT.

Agronomy.

Professor Beaumont, Assistant Professor Cubbon, Mr. Thayer.

The courses in agronomy are designed to give instruction concerning the basic knowledge of the soil and its management, fertilizers and their use, and the principal products of the field. An important objective of our undergraduate teaching is to give supporting training to groups specializing in other departments. For undergraduates desiring to specialize in agronomy adequate courses are offered, but for those expecting to go into advanced educational or research work our graduate training is recommended as preferable.

Elective Courses.

1. **I.** Field Crops. — The course deals with the most important field crops of the world, but emphasizes those of special importance in New England.
2 class hours. 1 2-hour laboratory period, credit, 3.
Laboratory fee, $2.25. Assistant Professor Cubbon.

3. **III.** Soil Management. — An introductory course covering the properties and management of soils.
2 class hours. 1 2-hour laboratory period, credit, 3.
Laboratory fee, $2.25. Assistant Professor Cubbon.

50. **II.** Crop Production for Dairy and Stock Farms. — For juniors; seniors may elect. An intensive study of methods and problems of production of those field crops of greatest importance in the successful management of New England dairy stock farms. Special attention will be given to the conditions found on the Massachusetts general farm, on which dairying and stock-raising are important.
2 class hours. 1 2-hour laboratory period, credit, 3.
Laboratory fee, $2.25. Assistant Professor Cubbon.
Prerequisite, Agronomy 27.

51. **III.** Advanced Field Crops (1930–31). — For juniors and seniors. This course is designed primarily for those specializing in field crops. Studies begun in Course 50 will be continued and extended to crops of importance beyond the range of New England. Theory and practice of crop improvement by plant breeding will be given attention. Given in alternate years.
2 class hours. 1 2-hour laboratory period, credit, 3.
Laboratory fee, $2.50. Assistant Professor Cubbon.
Prerequisite, Agronomy 50.

52. **I.** Soil Fertility. — For juniors; seniors may elect. A study of factors affecting soil fertility, with special attention to organic matter, soil reaction, and the use of fertilizers. Attempt will be made to meet the special needs of groups of students from other majors.
2 class hours. 1 2-hour laboratory period, credit, 3.
Assistant Professor Cubbon.

53. **III.** Soil Utilization. — For juniors; seniors may elect. Primarily for those not having had other courses in soils. Deals with the nature and properties of soil types, their adaptation to crops, and special problems arising in the management of extreme soil types.
3 class hours. Credit, 3.
Assistant Professor Cubbon.

77. **II.** Fertilizers. — For seniors; juniors may elect. A study of the source, properties, and behavior of commercial fertilizers and soil amendments. Attention will be given to such questions as home-mixed versus commercial fertilizers, the use of concentrated materials, and the economical purchase of fertilizers.
1 class hour. 2 2-hour laboratory periods, credit, 3.
Professor Beaumont.

78. I. Crop Improvement (1931–32). — For seniors; juniors may elect. Theory and practice of plant breeding and selection as applied to field crops. Given in alternate years.
2 class hours. 1 2-hour laboratory period, credit, 3.
Assistant Professor Cubbon.

80. III. Agronomic Literature. — For juniors and seniors in agronomy. Practice will be given the student in looking up original sources of agronomic knowledge and in preparing reports and abstracts.
3 class hours. Credit, 3.
Professor Beaumont.

Animal Husbandry.

Professor Rice, Assistant Professor Glatfelter, Mr. Foley.*

The courses in animal husbandry are offered to meet the needs of students interested in the various phases of live-stock farming and market-milk production; agricultural college teaching; high and secondary school teaching; federal, state, railroad, bank, or breed extension services; federal or state experiment station service; meat-packing industry; commercial feed industry.

Elective Courses.

1. II. Dairy Breeds. — This course includes a survey of the dairy industry. The origin, history, development, and characteristics of the dairy breeds, and their adaptability to New England conditions are studied. Preliminary work in scoring animals according to the recognized standards is given, followed by comparative judging and placing.
2 class hours. 1 2-hour laboratory period, credit, 3.
Laboratory fee, $1.50. Mr. Foley.

26. III. Horses, Swine, Sheep, and Beef Cattle. — For sophomores; juniors and seniors may elect. In this course consideration is given to the origin, history, development, and characteristics of the breeds of horses, swine, sheep, and beef cattle. Types, market classes, and grades of live stock are studied, together with their economic importance to the country in general, and to Massachusetts in particular. Preliminary work is given in scoring each type of animal, followed by judging and placing of groups.
2 class hours. 1 2-hour laboratory period, credit, 3.
Laboratory fee, $1.50. Assistant Professor Glatfelter.

29. III. Survey and Judging of Live Stock. — For sophomores; juniors and seniors may elect. This course includes a survey of the live stock industry. The origin, history, development, characteristics, distribution, and adaptability of each important breed of dairy cattle, beef cattle, sheep, swine, and horses are studied. Preliminary work in the scoring of pure-bred animals according to recognized standards is given, which is followed by considerable practice in judging and placing classes of live stock. This course is especially arranged for students enrolled in the Division of Social Sciences, and for others feeling a need for a general animal husbandry course.
2 class hours. 1 2-hour laboratory period, credit, 3.
Assistant Professor Glatfelter.

50. I. The Nutrition of Farm Animals.—For juniors; seniors may elect. This course consists of a study and application of the principles of physiological chemistry to the practical problems of animal feeding and growth. Consideration will be given to the chemical composition of plant and animal life; physiology of digestion; functions of vitamines, minerals, protein, and energy; feeding standards and their application; the composition of farm crops, their by-products, and commercially mixed feeds, and their utilization for the economical production of live stock and their products.
3 class hours. Credit, 3.
Professor Rice.

Prerequisites, Animal Husbandry 25 and 26.

* Mr. Foley's appointment is temporary.

51. **II.** The Feeding of Farm Animals. — For juniors; seniors may elect. A study of feeding practices as related to all classes of farm animals. This course is the complement of Course 50 and is for the purpose of demonstrating the applications of the science of nutrition to practical feeding problems. Considerable work will be given in the formulating of rations.
3 class hours. Credit, 3.
Assistant Professor Glatfelter.
Prerequisite, Animal Husbandry 50.

52. **III.** Advanced Live-stock Judging. — For juniors; seniors may elect. This course serves as a laboratory supplement to Animal Husbandry 53. It has three aims: (*a*) to train the student to see and evaluate differences in farm animals; (*b*) to begin the training of men who will act as judges of live stock at fairs; (*c*) to develop judging teams in both fat stock and dairy cattle to represent the college in the intercollegiate live-stock judging contest at the leading expositions. Trips will be taken each Saturday during the term to the leading herds and flocks in Massachusetts and nearby states. Approximate expense of travel is twenty-five dollars.
1 2-hour laboratory period on Friday, and all day Saturday, credit, 3.
Professor Rice.
Prerequisites, Animal Husbandry 25 and 26.

53. **III.** The Breeding and Improvement of Farm Animals. — For juniors; seniors may elect. This course is planned to give a broad view of the rise of many types of breeds from one ancestral stock; to note the origin, value, and permanence of certain variations; and to make clear the reasons for certain excellencies. The course also deals with the physiology of reproduction and with genetics, as a foundation for experience in actual production.
3 class hours. Credit, 3.
Professor Rice.
Prerequisites, Animal Husbandry 25 and 26; Zoölogy 26.

54. **II.** Meat and Meat Products. — For juniors; seniors may elect. This course deals with the manufacture of animals into their various commercial products and the distribution of these products to the consumer. Practice is given in the slaughtering of beef cattle, hogs, and sheep; judging of carcasses; cutting and curing of meats. The practical work is augumented by studies in the grading of fat stock, in packing-house methods, in the magnitude and trends of the meat industry, and in the opportunities of local New England marketing.
1 class hour. 1 4-hour laboratory period, credit, 3.
Professor Rice and Mr. Foley.

75. **I.** Dairy Cattle and Milk Production. — For seniors. Consideration is given to the application of the principles of animal nutrition to the particular problems of dairy cattle feeding. Methods of feeding for high milk production are studied. Cost of milk production, and breeding and management problems are carefully considered. A survey is made of recent experiment station results.
2 class hours. 1 2-hour laboratory period, credit, 3.
Laboratory fee, $1.50. Professor Rice and Mr. Foley.
Prerequisites, Animal Husbandry 25, 50, 52, and 53.

76. **II.** Beef and Sheep Production. — For seniors. Application of the principles of nutrition is made to the feeding of beef cattle and sheep. Feeding, breeding, and management problems are considered. A survey is made of recent experiment station work, and special study is given to the opportunities for the Massachusetts farmer to produce high-quality beef and lamb.
2 class hours. 1 2-hour laboratory period, credit, 3.
Assistant Professor Glatfelter.
Prerequisites, Animal Husbandry 26, 50, and 52.

77. **III.** Horses and Swine Production. — For seniors. This course is planned to familiarize students with the application of the principles of nutrition

to the feeding of horses and swine. Physiological and economic factors are considered in selecting suitable feeds. Cost of production, and breeding and managerial problems in commercial horse and pork production are considered. A study is also made of recent experiment station results in feeding, breeding, and management.

2 class hours. 1 2-hour laboratory period, credit, 3.
Professor Rice.

Prerequisites, Animal Husbandry 26, 50, 52, and 53.

80. **III.** Dairy Herd Management. — For seniors. The course includes a study of systems of dairy herd management; record form; methods of cost accounting; fitting for production, show, and sale; cow testing and bull association work.

2 class hours. 1 2-hour laboratory period, credit, 3.
Professor Rice.

81. **II.** 82. **III.** Animal Husbandry Seminar. — Required of students majoring in animal husbandry. Students will prepare original papers and talks on various pertinent topics. Round table discussions of animal husbandry investigational work and practices will be conducted. Frequent addresses will be made to the class by prominent breeders and scientists.

1 class hour. Credit, 1.
Professor Rice.

Dairy Industry.

Professor Frandsen, Assistant Professor Mack, Mr. Lindquist.

The courses in dairy industry are offered to meet the needs of students interested in the handling of market milk, and the science and art of butter making, ice-cream making, and cheese making; agricultural college teaching, and experiment station work; high and secondary school teaching; extension work; research and investigational work.

Elective Courses.

25. **III.** General Dairying. — For juniors; seniors may elect. A general course, prerequisite to all other dairying courses except 51 and 53, and for those who wish to take only one course in dairying to get a general knowledge of the subject. The work covers briefly: a study of milk, its secretion, composition, and various tests applied thereto; methods of handling milk and cream; the use of separators; elements of butter making, cheese making, and ice-cream making.

2 class hours. 1 2-hour laboratory period, credit, 3.
Laboratory fee, $3.00. Professor Frandsen and Mr. Lindquist.

51. **II.** Judging Dairy Products. — For juniors; seniors may elect. A study of standards and grades of dairy products, with practice in judging milk and ice cream, as well as butter and cheese. The student learns to recognize quality in dairy products, to detect specific defects, and to know their causes and the means of their prevention.

Laboratory fee, $3.00. 1 2-hour laboratory period, credit, 1.
The Department.

52. **III.** Market Milk. — For juniors; seniors may elect. A study of the various phases of the market milk industry: sanitary production, transportation, marketing, handling in the city plant, delivery systems, milk and its relation to the public health, inspection, milk laws, food value, and advertising. Some milk plants will be visited. The approximate expense of travel is five dollars.

3 class hours. 2 2-hour laboratory periods, credit, 5.
Laboratory fee, $3.00. Mr. Lindquist.
Prerequisite, Dairy 50.

53. **III.** Advanced Judging of Dairy Products. — For juniors; seniors may elect. The judging of milk, ice cream, butter, and cheese, using standard commercial methods and official score cards. A team is chosen from this class to represent the college in dairy products judging contests at the Eastern States Exposition and the National Dairy Show.

2 2-hour laboratory periods, credit, 2.
The Department.

Prerequisite, Dairy 51.

75. **I.** Milk Products (1931–32). — For juniors and seniors. The manufacture of milk products other than butter and ice cream, including cheddar cheese, soft and fancy cheese, condensed and powdered milk, casein, commercial buttermilk, etc. Laboratory exercise largely in cheese making and commercial buttermilk manufacture. Given in alternate years.

1 class hour. 1 4-hour laboratory period, credit, 3.
Laboratory fee, $3.00. Mr. Lindquist.
Prerequisite, Dairy 50, previously or in conjunction.

76. **I.** Advanced Testing (1930–31). — For juniors and seniors. The work covers moisture and fat testing for all dairy products; the casein test; salt test for butter; acid tests; work with the Monjonnier apparatus; and many other applied chemical tests used in dairy manufactures work. Given in alternate years.

Laboratory fee, $3.00. 2 4-hour laboratory periods, credit, 4.
Assistant Professor Mack.
Prerequisite, Dairy 50, previously or in conjunction.

77. **II.** Butter Making (1930–31). — For juniors and seniors. A study of separators and cream separation; handling milk and cream for butter making; preparation of starters, and ripening cream; churning, markets and their requirements; marketing, scoring, and judging butter; creamery management; care of butter-making equipment; problems. Given in alternate years.

2 class hours. 2 3-hour laboratory periods, credit, 5.
Laboratory fee, $3.00. The Department.
Prerequisite, Dairying 50.

78. **III.** Ice-Cream Making (1931–32). — For juniors and seniors. A study of the principles and practice of ice-cream making. The laboratory instruction will cover commercial practices. Some ice-cream plants will be visited. The approximate expense of travel is five dollars. Given in alternate years.

2 class hours. 2 3-hour laboratory periods, credit, 5.
Laboratory fee, $3.00. Assistant Professor Mack.
Prerequisite, Dairying 50.

79. **I.** 80. **II.** 81. **III.** Seminar. — For students majoring in dairy manufactures. This course consists of a study of the work accomplished by various experiment stations, also a review of foreign literature. Students will prepare papers on various dairy subjects. Frequent addresses will be made to the class by visiting dairy authorities.

1 class hour. Credit, 1.
Professor Frandsen.

Farm Management.

Professor Foord, Assistant Professor Barrett.

The purpose of the courses in this department is to train men to manage farms and other agricultural enterprises, as well as to prepare them for research and teaching in similar lines.

Elective Courses.

75. **I.** Farm Organization. — For seniors. A general course in the organization and business management of the farm. A study of regions and types of

farming; the farmer as a business proprietor; funds for investment in the farm business; use of labor, land, equipment, and materials; selection and combination of factors of farm production. Discussions of the size of the farm business, farm balance, farm layout and arrangement.
2 class hours. 1 2-hour laboratory period, credit, 3.
Assistant Professor Barrett.
Prerequisite, the required sophomore work in agriculture or horticulture, or the permission of the instructor.

76. **II.** Farm Operation and Cost Accounting. — For seniors. A continuation of Course 75. A study of the means of production, and the selection and combination of farm enterprises. Discussions of the nature of farming costs, the farmer's profits, and the farmer as a technical expert. The consideration of farm records and accounts as a basis for efficient operation.
2 class hours. 1 2-hour laboratory period, credit, 3.
Assistant Professor Barrett.
Prerequisite, Farm Management 75.

77. **III.** Advanced Farm Organization. — For seniors. A further and more specific study of the principles and practices outlined in Courses 75 and 76, with special reference to their application to farms in Massachusetts. Field trips are required. The approximate expense for travel is five dollars.
1 class hour. 1 4-hour laboratory period, credit, 3.
Assistant Professor Barrett.
Prerequisites, Farm Management 75 and 76.

78. **II.** 79. **III.** Seminar. — For seniors majoring in general agriculture; others by arrangement.
1 class hour. Credit, 1.
Professor Foord.

81. **III.** Types of Farming in the United States. — For seniors. A study of the agricultural regions of the United States and the different types and methods of farming carried on in each. The economic reasons for the establishment and maintenance of each type will be considered.
2 class hours. 1 2-hour laboratory period, credit, 3.
Professor Foord.

Poultry Husbandry.

Professor Graham, Professor Sanctuary, Assistant Professor Banta, Mr. Vondell.

The department aims to give instruction in the science, art, and practices of poultry keeping not only to the men majoring in this department, but also to students majoring in other departments and desiring supporting courses in poultry husbandry. Our major courses prepare men for the successful operation of commercial poultry farms and marketing projects either as owners or managers; for graduate work, teaching, extension and investigational work.

Elective Courses.

25. **I.** Farm Poultry. — For seniors; juniors may elect. For those students who desire a general knowledge of poultry husbandry but who cannot devote more than one term to the subject; it is not intended for students specializing in poultry, and such students are admitted only by special permission. Emphasis is placed on the farm flock and its economic management. Utility classification, housing, culling, feeding, hatching, rearing, production, marketing, and disease control receive special consideration.
2 class hours. 1 2-hour laboratory period, credit, 3.
Assistant Professor Banta.

50. **I.** Poultry Judging. — For juniors; seniors may elect. A study of the origin and evolution of our standard breeds and varieties of domestic fowl; judging production quality, using trapnested birds; judging exhibition quality

by score card and comparison. One or more poultry farms, an egg-laying contest, and a poultry show will be visited. Poultry judging teams competing in the inter-collegiate contest at Madison Square Garden each January are trained in this course.

2 class hours. 2 2-hour laboratory periods, credit, 4.
Assistant Professor BANTA.

51. **II.** POULTRY FEEDS AND FEEDING. — For juniors; seniors may elect. A study of the common feeds and the scientific principles underlying the field of nutrition. Recent experimental work and current feeding problems will receive special consideration. For observational practice and accumulation of original data, the management of a pen of birds will be required for a period of a few weeks.

3 class hours. 2 2-hour laboratory periods, credit, 5.
Laboratory fee, $2.50. Assistant Professor BANTA.

52. **III.** INCUBATION AND BROODING. — For juniors; seniors may elect. A study of the fundamental principles underlying incubation and brooding practices. The science of physics and general biology is applied to the study of incubation and brooding processes. Students become thoroughly acquainted with modern incubation and brooding equipment through detailed study and operation of typical incubators and brooders. Present-day problems are considered and some are investigated as a part of the class work.

2 class hours. 2 2-hour laboratory periods, credit, 4.
Laboratory fee, $3.00. Mr. VONDELL.

75. **I.** POULTRY HOUSING AND SANITATION. — For seniors. A consideration of the biological needs of poultry from the standpoint of housing, and the economic principles governing designing and construction of poultry houses and equipment for poultry farm buildings. The course also embodies a study of the principles of poultry sanitation, including external parasites and the insecticidal agents for their control.

3 class hours. Credit, 3.
Professor SANCTUARY.

76. **I.** MARKET POULTRY AND POULTRY PRODUCTS. — For seniors. A study of market classes of poultry and eggs; preparation of poultry products for market; requirements of different markets; methods of marketing, involving a study of distribution, finances, and business organizations; cold storage and transportation; advertising, prices, and food values. Laboratory exercises in candling, packing, killing, dressing, and similar operations to make the above named factors more concrete. Students are required to fatten pens of chickens by different methods and rations, keeping accurate data of the gains in weight and quality, also the costs of feed and labor, and resultant profit or loss. Competitive judging of the exhibits in the Annual Market Poultry Show, staged by the members of this class, is a feature of the course. When possible, a short trip to Springfield is arranged to study cold storage plants and the handling of poultry products in the local market.

2 class hours. 1 2-hour laboratory period, credit, 3.
Laboratory fee, $2.00. Assistant Professor BANTA.

77. **II.** POULTRY BREEDING. — For seniors. Methods of selection and improvement of poultry are developed through the study of the principles of heredity. Most of the course centers around the progeny test and pedigree method of breeding. Students taking this course participate in the college plant selection in pedigree work. Three breeds of poultry, each pedigreed for from seven to twenty years, furnish practice materials.

4 class hours. 1 2-hour laboratory period, credit, 5.
Laboratory fee, $2.00. Professor SANCTUARY.

79. **III.** POULTRY FARM ORGANIZATION. — For seniors. This course embodies the application of economic and business principles to poultry farming. The place and importance of the various branches of well-organized poultry

farms and their relation to each other receive special consideration; also the study of surveys and production costs. A trip covering two or three days will be made to representative successful poultry farms. The expense per student is approximately fifteen dollars. This trip is required of each student taking the course for credit.

2 class hours. 1 2-hour laboratory period, credit, 3.
Professor SANCTUARY.

Prerequisite, Poultry 77.

80. **I, II,** and **III.** POULTRY PROBLEMS. — Open to seniors only. This course consists of individual problems chosen by the students under guidance of the department. The work is of an advanced nature, supplementing that of the regular poultry curriculum. Copy of project outline, indicating the number of credits, must be filed with the department and with the Dean at the opening of the term.

Credit, 1 to 4.
The DEPARTMENT.

DIVISION OF HOME ECONOMICS.

Professor SKINNER.

Home Economics.

Professor SKINNER, Assistant Professor KNOWLTON, Assistant Professor TUCKER.

The home economics courses offered are planned to meet the needs of (1) those students who are interested in education for homemaking as an integral part of the general education of women; (2) those who wish to enter a graduate school leading to professional work; (3) those who are interested in preparing for home economics extension service, both junior and adult; (4) those who are interested in professional or vocational work in which an understanding of home economics is fundamental, such as family or community welfare work, etc.; (5) those who wish to teach home economics, in which case certain elective courses should be chosen in the Department of Agricultural Education to secure a Massachusetts teacher's certificate. Other departments offer courses planned especially for students in home economics, as follows: House Planning and Construction in the Department of Agricultural Engineering; General Design in the Department of Landscape Gardening; and Food Preservation in the Department of Horticultural Manufactures.

Elective Courses.

1. **I.** INTRODUCTION TO HOME ECONOMICS. — For freshman women. A brief study of the share which women have had in social progress, in order that each student may recognize the importance of her relationships to her own family group, and may become conscious of problems in the modern home which need to be considered.

3 class hours. Credit, 3.
Miss SKINNER.

2. **II.** CLOTHING APPRECIATION AND DESIGN. — For sophomores; juniors and seniors may elect. Line, design, and color in relation to the college student's wardrobe will be studied. The care of clothing will also be included.

2 class hours. 1 2-hour laboratory period, credit, 3.
Laboratory fee, $1.00. Miss TUCKER.

3. **III.** FOODS. — For sophomores; juniors and seniors may elect. A study of foods in their scientific and economic aspects, with the preparation of simple meals.

1 class hour. 2 3-hour laboratory periods, credit, 3.
Laboratory fee, $3.00. Miss KNOWLTON.

28. **I.** CLOTHING SELECTION AND CONSTRUCTION. — For sophomores; juniors and seniors may elect. This course includes a study of the selection and

purchase of suitable materials, of the use of commercial patterns, and of practical methods of making simple garments. The estimated cost of materials used is from five to ten dollars.

1 class hour. 2 2-hour laboratory periods, credit, 3.
Laboratory fee, $1.50. Miss Tucker.

32. **II.** Applied Design. — For sophomores; juniors and seniors may elect. Applications of the principles of design are worked out in specific problems, using various media. Much opportunity is allowed for individual expression. The estimated cost of materials used is five dollars.

3 2-hour laboratory periods, credit, 3.
Laboratory fee, $1.50. Miss Tucker.
Prerequisite, Drawing 30.

40. **I.** Foods. — For juniors; seniors may elect. A further study of food values and the day's meals as a whole. Especial emphasis on economy in expenditure of money, time, and labor.

1 class hour. 2 2-hour laboratory periods, credit, 3.
Laboratory fee, $4.00. Miss Knowlton.
Prerequisite, Home Economics 30, or permission of instructor.

46. **III.** Clothing and Textiles. — For juniors; seniors may elect. A study of the production, manufacture, identification, and use of the common textile fibers. Class trips to textile mills will be included, at an estimated expense of two dollars. Laboratory work in the construction of garments is used as a basis for a study of ready-made garments. The estimated cost of materials used is from five to ten dollars.

1 class hour. 2 2-hour laboratory periods, credit, 3.
Laboratory fee, $1.50. Miss Tucker,
Prerequisites, Home Economics 25 and 32; Drawing 30; Home Economics 28 is also prerequisite for those majoring in home economics.

51. **II.** Nutrition. — For juniors; seniors may elect. A study of food needs throughout infancy, childhood, adolescence, adult life, and old age, considering the energy value of foods and the nutritive properties of foodstuffs. Typical dietaries are planned for each period, with special regard to nutritive requirements.

2 class hours. 2 3-hour laboratory periods, credit, 5.
Laboratory fee, $2.00. Miss Knowlton.
Prerequisites, Home Economics 30 and 50; Chemistry 30.

58. **III.** General Course in Foods and Nutrition. — For juniors and seniors, not home economics majors, both men and women. A survey of the principles of food preparation, meal planning, and food values, with emphasis on the relation of good nutrition to health.

2 class hours. 1 3-hour laboratory period, credit, 3.
Laboratory fee, $4.00. Miss Knowlton.

60. **II.** Household Equipment. — For juniors and seniors. Consideration of the labor problems in the home, including a study of the selection, operation, care and efficient arrangement of equipment, with an analysis of the time and energy required in various processes. The department of Agricultural Engineering cooperates in the study of certain problems in this course.

2 class hours. 1 2-hour laboratory period, credit, 3.
The Departments of Agricultural Engineering and Home Economics.

61. **III.** Home Furnishing. — For juniors; seniors may elect. A study of the fundamental principles which underlie the successful planning and furnishing of a satisfying home. Many applications of these principles are worked out in practical problems. Class trips will be taken at an estimated expense of $2.00.

3 class hours. 2 2-hour laboratory periods, credit, 5.
Laboratory fee, $1.50. Miss Tucker.
Prerequisites, Drawing 30; Agricultural Engineering 53.

76. **I.** Home Management. — For seniors. The application of the principles of scientific management to the household, and the elements of successful home making. The family income, cost of living, household accounts, the budget and its apportionment. The responsibility of the woman to her family and the community in establishing right standards of living.
3 class hours. Credit, 3.
Miss Skinner.

77. **I, II,** and **III.** Home Management Practice. — For seniors. Students will live in the Home Management House for an interval varying in length from one-half term to one term, and study concrete problems in home management.
Credit, 3 or 5.
Miss Knowlton.
Prerequisites, Home Economics 30, 50, 51, 61, 76, and the approval of the department.

79. **II.** Child Care and Training. — For seniors. This is a study of the physical and mental growth and development of the child, the rational care of children at various ages, the treatment in behavior problems, and the influence of environment in shaping personality. Field trips at an estimated cost of $2.00.
3 class hours. Credit, 3.
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80. **III.** Problems of the Family (1931–32). — For juniors and seniors. This course will consist of a study of the problems of family life in relation to the modern social organization. Its aim will be to develop an intelligent social consciousness and a sense of individual responsibility in family relationships. Given in alternate years.
3 class hours. Credit, 3.
Miss Skinner.

81. **I.** Methods of Teaching Home Economics. — For seniors, by arrangement with the head of the division. This course will discuss educational objectives as applied to the teaching of home economics in the junior and senior high schools, the psychological basis for teaching; evaluation of instructional material, selection and organization of subject matter; methods of teaching, and space and equipment.
2 class hours. 1 2-hour laboratory period, credit, 3.
The Department.
Prerequisite, Agricultural Education 56.

82. **II.** Problems in Elementary Nutrition. — For seniors. This course is intended to show how the home economics graduate fits into the health program of the school, either as a teacher or as a volunteer worker. Recommended only to those pursuing a major in home economics.
2 class hours. 1 2-hour laboratory period, credit, 3.
The Department.

83. **III.** Field Problems under Supervision. — For seniors. This course is intended to be a more intensive application of home economics to special community problems and to serve as a beginning of simple research work. Recommended only to those pursuing a major in home economics. Required trips, at an estimated cost of five dollars.
2 class hours. 1 2-hour laboratory period, credit, 3.
The Department.

85. **II.** Clothing Economics. — For seniors. This course includes a study of clothing budgets for college students and business women, and a critical analysis of sources of clothing information. Some special investigation is carried on by each student. Advanced work in garment construction is continued. The estimated cost of materials used is from seven to twelve dollars.
2 class hours. 1 3-hour laboratory period, credit, 3.
Laboratory fee, $1.50. Miss Tucker.
Prerequisite, Home Economics 56.

DIVISION OF HORTICULTURE.

Professor WAUGH.

Floriculture.

Professor THAYER, Assistant Professor HUBBARD.

The courses in floriculture are intended to present a general knowledge of all phases of greenhouse design, construction, heating, and management, the culture of florists' crops (under glass and outdoors), floral decoration and arrangement, and the marketing of plants and flowers. The department aims to train students so that they may take up various phases of commercial floriculture, positions in nursery establishments, and the management of conservatories on private estates, in parks and cemeteries.

Elective Courses.

25. **II.** GARDEN FLOWERS AND BEDDING PLANTS. — A study of the annuals, biennials, herbaceous perennials, bulbs, bedding plants, and roses that are valuable for use in floricultural or landscape gardening work. Methods of propagation, culture and uses of the various plants are considered; identification of material. Lectures, assigned readings, and reports.
2 class hours. 1 2-hour laboratory period, credit, 3.
Laboratory fee, $1.50. Professors THAYER and HUBBARD.

50. **I.** GREENHOUSE MANAGEMENT. — For juniors; seniors may elect. Designed to familiarize students with the methods followed in the management of greenhouses and greenhouse crops, and the principles underlying the same; history and development of the floricultural industry; preparation of soils; fertilizers; potting; watering; ventilation; control of insects and diseases; methods of plant propagation; forcing of plants. At some time during the term the members of the class will be required to take a one-day trip to visit large commercial establishments. The approximate expense of the trip is five dollars. Lectures, assigned readings, reports, and laboratory practice.
2 class hours. 2 2-hour laboratory periods, credit, 4.
Laboratory fee, $1.50. Professor THAYER.
Prerequisites, Horticulture 25, 26, and 27.

51. **II.** GREENHOUSE MANAGEMENT. — For juniors; seniors may elect. Continuation of Course 50. Several field trips, to study floricultural establishments in the vicinity, will be made during the laboratory periods. The approximate expense of the trips is three dollars.
2 class hours. 1 4-hour laboratory period, credit, 4.
Laboratory fee, $1.50. Professor THAYER.
Prerequisite, Floriculture 50.

52. **III.** FLORAL ARRANGEMENT. — For juniors; seniors may elect. A study of the principles underlying the arrangement and use of cut flowers and plants; funeral designs, basket and vase arrangement, table decorations, home, church, and all interior decorations; a study of color as applied to such work. Lectures, assigned readings, and reports. This course is limited to ten students.
2 class hours. 2 2-hour laboratory periods, credit, 4.
Laboratory fee, $5.00. Professor THAYER.

53. **I.** GREENHOUSE CONSTRUCTION AND HEATING. — For juniors; seniors may elect. The location, types, arrangement, construction, cost, equipment, heating, and ventilating of greenhouse structures; the drawing of plans and study of specifications for commercial houses and conservatory ranges. Such practical work as glazing and the construction of concrete benches and cold frames is included as facilities allow. Lectures, assigned readings, and problems.
3 class hours. 1 2-hour laboratory period, credit, 4.
Laboratory fee, $1.00. Professor THAYER.

58. **III.** AMATEUR FLORICULTURE. — This course is intended primarily for major students in the Division of Home Economics, and other women students. Three phases of floriculture will be considered briefly, the arrangement and use

of cut flowers for various purposes in the home, house plants and their culture, and the small home garden.
2 class hours. 1 2-hour laboratory period, credit, 3.
Laboratory fee, $2.50. Professor THAYER.

75. **I.** 76. **II.** COMMERCIAL FLORICULTURE. — For seniors. A detailed study of the cultural methods of the important commercial cut-flower crops and potted plants. Visits will be made to commercial establishments during the courses. The lectures are supplemented with textbooks and assigned readings.
2 class hours. 1 2-hour laboratory period, credit, 3.
Laboratory fee, $2.00 per term. Assistant Professor HUBBARD.
Prerequisite, Floriculture 51.

77. **III.** COMMERCIAL FLORICULTURE. — For seniors. The marketing of flowers and plants, including the management of wholesale markets and retail flower stores; a study of systems of record keeping, cost analysis, inventory methods, and other phases of this important part of the floricultural industry.
2 class hours. 1 2-hour laboratory period, credit, 3.
Assistant Professor HUBBARD.
Prerequisite, Floriculture 76.

79. **II.** CONSERVATORY PLANTS (1930–31). — Alternates with Course 80. For juniors and seniors. A study of the foliage and flowering plants used in conservatory work; methods of propagation; assigned readings and reports.
2 class hours. 1 2-hour laboratory period, credit, 3.
Laboratory fee, $2.00. Professor THAYER.

80. **II.** PROBLEMS IN FLORICULTURE (1931–32). — Alternates with Course 79. For juniors and seniors majoring in floriculture. Advanced study of subjects pertaining to some phase of floriculture. All students are assigned specific problems and pursue study in these problems by reading and research. The results of this study must be presented in the form of a thesis. Discussions are conducted weekly.
1 class hour. 2 to 4 laboratory hours, not to exceed 3 credits.
Professor THAYER.

81. **III.** SEMINAR. — For seniors in floriculture. Presentation and discussion of research work in floriculture and other related fields, reports on assignments by individual members of the class, and the preparation of a thesis dealing with an assigned subject. Seminars are conducted weekly.
1 class hour. 2 to 4 laboratory hours, not to exceed 3 credits.
Professor THAYER.

Forestry.

Professor HOLDSWORTH.

The forestry courses are intended primarily for prospective owners or managers of farm woodlots, and the field work is focused on typical New England problems. These courses are broad enough, however, to furnish valuable preparation for students planning to study forestry in graduate schools.

Elective Courses.

55. **I.** WOODLOT FORESTRY: ESTIMATING AND BUSINESS MANAGEMENT. — For juniors and seniors. Topics: forest mapping; timber cruising; determining rate of growth and possible cut; financial returns; forest taxation; our national timber supply, present and future.
1 2-hour and 1 4-hour laboratory period, credit, 3.
Laboratory fee, $1.00. Professor HOLDSWORTH.

56. **II.** WOODLOT FORESTRY: LOGGING, MILLING, AND MARKETING. — For juniors and seniors. Topics: felling trees; sawing logs; hauling logs; the port-

able mill; the stationary mill; seasoning, measuring, and shipping lumber; lumber grades and prices; legal forms; by-products of the woodlot; adaptability of species to uses; wood-using industries of Massachusetts.

2 class hours. 1 2-hour laboratory period, credit, 3.
Professor Holdsworth.

Prerequisite, Forestry 55.

57. **III.** Woodlot Forestry: Timber-raising. — For juniors and seniors. Topics: forest planting; weeding; release cuttings; pruning; thinning; salvage cutting; protection from insects, fungi, fire, etc.; final cutting methods for natural reproduction of the forest.

1 2-hour and 1 4-hour laboratory period, credit, 3.
Laboratory fee, $1.00. Professor Holdsworth.

58. **III.** Woodlot Forestry: Brief Survey. — For juniors and seniors. A condensation of Courses 55, 56, and 57 for those who have only one term to give to forestry.

2 class hours. 1 2-hour laboratory period, credit, 3.
Laboratory fee, $1.00. Professor Holdsworth.

Horticultural Manufactures.

Professor Chenoweth, Mr. Rice.

The courses aim to give a knowledge of the practical problems connected with food preservation, with some skill in the manipulation of materials and equipment, together with a clear understanding of the scientific principles involved. Emphasis is placed upon the conservation of the cheaper grades of fruits and vegetables to the end that the entire crop may be marketed and that wholesome food may be produced from materials that would otherwise be lost. The social and economic values of this type of work and its relations to modern methods of living are emphasized.

Elective Courses.

75. **I.** Horticultural Manufactures. — For seniors and graduate students. A practical course in food preservation dealing primarily with fruits and vegetables. The canning of fruits and vegetables as practiced in the home and in commercial canneries. The manufacture of (*a*) fruit products, such as butters, jams, jellies, juices, marmalades, vinegars, etc., and (*b*) vegetable products, such as pickles, piccalilli, sauerkraut, etc. Particular attention is given to the study and use of all types of equipment suitable for the home or small factory, together with methods for testing and judging a large variety of manufactured products.

2 class hours. 3 2-hour laboratory periods, credit, 5.
Professor Chenoweth.

76. **II.** Horticultural Manufactures. — For seniors and graduate students. A continuation of Course 75. Emphasis is placed on the preservation of small fruits. A comparison of relative values of different varieties of small fruits for canning and manufacturing purposes. Judging of canned and manufactured fruit and vegetable products, together with a study of commercial grades and standards of canned goods.

1 class hour. 2 2-hour laboratory periods, credit, 3.
Professor Chenoweth.

Prerequisite, Horticultural Manufactures 75.

77. **III.** Horticultural Manufactures. — For seniors and graduate students. A continuation of Courses 75 and 76, dealing primarily with maple products and the canning of meats and the early spring vegetables. Also a study of special problems involved in establishing and operating home and farm factories. Visits to nearby farm factories and salting stations are required of all students.

2 2-hour laboratory periods, credit, 2.
Professor Chenoweth.

Prerequisites, Horticultural Manufactures 75 and 76.

78. **III.** Horticultural Manufactures. — For seniors and graduate students. Intended for the student who desires a broad, general knowledge of food preservation. A general course in food preservation, including lectures, readings, and laboratory exercises in the canning and drying of fruits and vegetables, and the manufacture of fruit and vegetable products. Emphasis is placed on the conservation of the low grades of fruits and vegetables in the home and the home factory.
2 class hours. 2 2-hour laboratory periods, credit, 4.
Professor Chenoweth and Mr. Rice.

80. **I.** Horticultural Manufactures. — For junior and senior women. A course dealing with the problems of food preservation in the home. Application of present-day knowledge is made to the practices of canning, pickling, and manufacturing the autumn fruit and vegetable products.
2 class hours. 2 2-hour laboratory periods, credit, 4.
Professor Chenoweth and Mr. Rice.

81. **II.** Horticultural Manufactures. — For junior and senior women. A continuation of Course 80. The preservation of small fruits and the home storage of fruits and vegetables. The use of salt in the home preservation of vegetables, the manufacture of pickles, and the canning of meats and poultry will constitute the main work in this course.
1 class hour. 2 2-hour laboratory periods, credit, 3.
Professor Chenoweth and Mr. Rice.
Prerequisite, Horticultural Manufactures 80.

82. **III.** Special Fruit Products. — For seniors; juniors may elect. A laboratory course in the manufacture of preserved fruits, candied fruits, candy fillers, fruit pastes, fruit candies and other fruit specialties.
Class limited to 12 students.
2 2-hour laboratory periods, credit, 2.
Professor Chenoweth.

Horticulture.

Professor Waugh, Professor Thompson, Assistant Professor Drain, Assistant Professor French.

The general subject of horticulture divides naturally into subjects of pomology, floriculture, forestry, landscape gardening, and vegetable gardening. A number of courses relate to more than one of these subjects, and are therefore grouped here under the general designation of horticulture.

Elective Courses.

1. **I.** Plant Propagation. — This course serves as an introduction to the field of horticulture, emphasizing the methods and underlying principles involved in the propagation of horticultural plants.
2 class hours. 1 2-hour laboratory period, credit, 3.
Assistant Professor French.

2. **II.** Horticultural Practices. — This course is designed to demonstrate and explain the principles underlying the practical cultivation of economic plants. Consideration will be given to the methods of propagation and to the culture of plants in their relation to soils, tillage, water, food supply, etc.
1 class hour. 2 2-hour laboratory periods, credit, 3.
Assistant Professor Drain.

25. **I.** Relationships and Associations of Horticultural Plants. — For sophomores. A study of the outstanding characters utilized in acquiring a practical knowledge of the principal species and varieties of cultivated plants, together with a consideration of those principles which determine the natural associations of plants in so far as they bear on the best methods of plant culture.
1 class hour. 2 2-hour laboratory periods, credit, 3.
Professor Thompson.

27. **III.** Breeding of Horticultural Plants. — For sophomores. A study of the principles of inheritance as applied to plants, together with a consideration of the methods used and problems involved in the improvement of horticultural crops.
3 class hours. Credit, 3.
Assistant Professor French.

50. **I.** Plant Materials. — For juniors; seniors may elect. The course aims to make the student familiar with the distinguishing characters of trees, shrubs, and woody vines used in ornamental plantings, together with the propagation and care of the same.
1 class hour. 2 2-hour laboratory periods, credit, 3.
Professor Thompson.

51. **III.** Plant Materials. — For juniors; seniors may elect. A continuation of Course 50, taking up the field uses of trees, shrubs, and woody climbers, their natural habitats, soils, and plant associations, with a view to supplying to the students in landscape gardening and floriculture a knowledge of the species and varieties used in ornamental planting. Frequent practicums and field excursions.
1 class hour. 2 2-hour laboratory periods, credit, 3.
Professor Thompson.

Prerequisite, Horticulture 50.

55. **III.** Advanced Plant Breeding. — For juniors; seniors may elect. An advanced study of experimental methods and biometry in plant breeding, Mendelian analysis, fluctuating variations, mutations, sterility, disease resistance, etc. Laboratory work in the experimental breeding of plants.
2 class hours. 1 2-hour laboratory period, credit, 3.
Assistant Professor French.

Prerequisite, Horticulture 27.

75. **III.** Horticulture Review. — Required of all seniors majoring in the Division of Horticulture. Designed to correlate the various branches of plant science and horticultural practice.
1 lecture hour, 1 conference period. Credit, 2.
Professor Waugh.

Landscape Architecture.

Professor Waugh, Assistant Professor Harrison, Assistant Professor Armstrong, Mr. Robertson.

The instruction in this department is aimed at two objectives: first, the contribution to general education; second, the preparation of men for the professional practice of landscape architecture. The former objective seems important from the fact that landscape architecture offers an excellent opportunity for the practical discussion of the principles underlying all the fine arts. In the professional courses students are prepared, as well as time permits, to begin work in landscape architecture which leads through field experience or post-graduate study to permanent establishment in that profession.

Drawing.

Elective Courses.

25. **I.** Free-Hand Drawing. — For sophomores; juniors and seniors may elect. Lettering; free-hand perspective; sketching from models; laying flat and graded washes in water colors; water-color rendering of leaves, flowers, and trees.
3 2-hour laboratory periods, credit, 3.
Laboratory fee, $1.50. Mr. Robertson.

26. **II.** Mechanical Drawing. — For sophomores; juniors and seniors may elect. Inking exercises; geometric problems; isometric projection; inter-

sections; shades and shadows; parallel, angular, and oblique perspectives; perspective drawings of buildings. Students should have preparation in plane and solid geometry.

3 2-hour laboratory periods, credit, 3.
Laboratory fee, $1.50. Mr. Robertson.

27. **III.** Elementary Design. — For sophomores; juniors and seniors may elect. Introduction to the principles of pure design, with various applications, especially in the field of landscape gardening.

3 2-hour laboratory periods, credit, 3.
Laboratory fee, $1.50. Professor Waugh.
Prerequisites, Drawing 25 and 26.

30. **I.** Elementary Design. — For sophomore women. Elementary principles of design, with application to costume design, interior decoration, etc.

3 2-hour laboratory periods, credit, 3.
Laboratory fee, $1.50. Mr. Robertson.

Landscape Architecture.

Elective Courses.

50. **I.** Mapping and Topography. — For juniors. Reconnoissance and topographical surveys and mapping, with special reference to the methods used in landscape architecture. Must be followed by Course 51.

2 2-hour and 2 3-hour laboratory periods, credit, 5.
Laboratory fee, $2.00. Assistant Professor Harrison.
Prerequisites, Mathematics 26 and 27; Drawing 25, 26, and 27.

51. **II.** Elements of Landscape Gardening. — For juniors. Study of the engineering details of landscape gardening; grade design, road design, drainage, play areas, etc.

3 3-hour laboratory periods, credit, 4.
Laboratory fee, $2.00. Assistant Professor Harrison.
Prerequisite, Landscape Architecture 50.

52. **III.** General Design. — For juniors. Detailed study of selected designs of leading landscape gardeners. Field notes; examination of completed works and those under construction; design of architectural details; written reports on individual problems.

2 2-hour and 2 3-hour laboratory periods, credit, 5.
Laboratory fee, $2.00. Assistant Professor Harrison.
Prerequisites, Landscape Architecture 50 and 51, and either plant materials (Horticulture 50) or advanced mathematics.

53. **II.** Garden Design. — For juniors; seniors may elect. The elementary principles of structural design as applied to the simpler garden forms — the so-called "natural" and "formal" styles; other garden forms.
1 class hour. 3 2-hour laboratory periods, credit, 4.
Laboratory fee, $2.00. Professor Waugh.
Prerequisite, Landscape Architecture 50.

75. **I.** Theory of Landscape Art. — For seniors and graduates. The general theory and application of landscape study.
3 class hours. Credit, 3.
Professor Waugh.

76. **III.** Civic Art. — For seniors. The principles and applications of modern civic art, including city planning, city improvement, and rural improvement, with special emphasis upon country planning.

3 3-hour laboratory periods, credit, 4.
Laboratory fee, $2.00. The Department.
Prerequisites, Landscape Architecture 52 and 53.

78. **II.** Architecture (1930–31). — Alternates with Course 79. For juniors and seniors. The history of architectural development, the different historic types, with special reference to the underlying principles of construction and their relation to landscape design. Illustrated lectures, field trips, the study of details, preparation of plates.
3 class hours. Credit, 3.
Assistant Professor Harrison.

79. **II.** Construction and Maintenance (1931–32). — Alternates with Course 78. For juniors and seniors. Detailed instruction in staking out work; methods of construction and planting; organization, reporting, accounting, estimating, etc.
3 class hours. Credit, 3.
Assistant Professor Harrison.

81. **I.** Residence Grounds Design. — For seniors. Grading and planting plans; garden designs and planting.
3 3-hour laboratory periods, credit, 4.
Laboratory fee, $2.00. Assistant Professor Harrison.
Prerequisites, Landscape Architecture 52 and 53.

82. **II.** Advanced Design. — For seniors. A series of problems in the design of estates, parks, and small property.
3 3-hour laboratory periods, credit, 4.
Laboratory fee, $2.00. Assistant Professor Armstrong.
Prerequisite, Landscape Architecture 81.

83. **III.** Park Design. — For seniors. Studies in modern park designs of various types.
3 3-hour laboratory periods, credit, 4.
Laboratory fee, $2.00. Assistant Professor Harrison.
Prerequisite, Landscape Architecture 82.

Olericulture.

Professor Waugh, Assistant Professor Snyder and Mr. Tuttle.

The purpose of the courses is to train men (1) for all the commercial branches of vegetable and seed production, and (2) for the professional fields of research, extension work, and teaching.

Elective Courses

25. **I.** General Olericulture. — A general consideration of fundamentals in vegetable production which may be applied to the growing of vegetables as a cash crop with other types of agriculture, the growing of vegetables in the home garden, agricultural instruction in secondary schools, and professional agricultural work other than teaching.
2 class hours. 1 2-hour laboratory period, credit, 3.
Laboratory fee, $2.00. Assistant Professor Snyder.

51. **I.** Olericulture. — For juniors; seniors may elect. A study of the principles underlying vegetable production; the vegetable plant, soil and its treatment, plant food, seed, and seedage.
2 class hours. 1 2-hour laboratory period, credit, 3.
Assistant Professor Snyder.

52. **II.** Olericulture. — For juniors; seniors may elect. A study of the principles underlying vegetable production; the vegetable plant and its responses to environmental conditions.
2 class hours. 1 2-hour laboratory period, credit, 3.
Laboratory fee, $2.00. Mr. Tuttle.

53. **III.** Olericulture. — For juniors; seniors may elect. A study of the principles underlying vegetable production; methods of culture, storage, marketing, and pest control.
2 class hours. 1 2-hour laboratory period, credit, 3
Laboratory fee, $2.00. Assistant Professor Snyder.
Prerequisite, Olericulture 50, 51, or 52.

75. **I.** Systematic Olericulture. — For seniors. A critical study of variety identification; nomenclature and classification; judging and exhibiting
2 class hours. 2 2-hour laboratory periods, credit, 4
Laboratory fee, $3.00. Assistant Professor Snyder.

76. **II.** Olericulture of Greenhouse Crops. — For seniors. A study of the principles underlying the culture of vegetables under glass.
2 class hours. 1 2-hour laboratory period, credit, 3
Laboratory fee, $2.00. Assistant Professor Snyder.

77. **III.** Commercial Olericulture. — For seniors. A critical study of the fundamental problems in the commercial production of vegetables. Visits to the leading market and truck sections in the state are required. Twenty-five dollars will cover such trips.
2 class hours. 1 2-hour laboratory period, credit, 3.
Assistant Professor Snyder.
Prerequisite, Olericulture 50, 51, or 52.

Pomology.

Professor Sears, Professor Van Meter, Assistant Professor Drain, Assistant Professor French, Mr. Roberts.

It is the object of the courses in pomology to give the student a thoroughly practical training, so that he may be able to perform or supervise all of the different operations in connection with the growing and marketing of the various fruits. At the same time he is given a thorough grounding in the scientific principles on which the practical work is based, in order that he may better understand the various practices taught.

Elective Courses.

25. **III.** Small Fruits. — A study of the growing of small fruits, including raspberries, blackberries, strawberries, currants, blueberries, and grapes, dealing with such questions as propagation, selecting a site for the plantation, soils, fertilizers, pruning, harvesting, marketing, etc.
2 class hours. 1 2-hour laboratory period, credit, 3.
Assistant Professor French.

53. **I.** General Pomology. — For juniors; seniors may elect. A study of the most approved practices in fruit production. Textbooks, lectures, and reference books; field and laboratory exercises.
2 class hours. 1 2-hour laboratory period, credit, 3.
Professor Sears and Mr. Roberts.

54. **II.** Systematic Pomology. — For juniors; seniors may elect. A study of varieties of fruits, including identification, nomenclature, relationships, and classification. This course is advised but not required of candidates for the varsity fruit judging team. Lectures, textbooks, laboratory and field exercises.
1 class hour. 2 2-hour laboratory periods, credit, 3.
Laboratory fee, $4.00. Assistant Professor Drain.
Prerequisite, Horticulture 27.

56. **III.** Spraying. — For juniors; seniors may elect. (*a*) Spraying materials, their composition, manufacture, and preparation for use; the desirable and objectionable qualities of each material; formulas used, cost, tests of purity.

(*b*) Spraying machinery, including all the principal types of pumps, nozzles, hose, and vehicles; their structure and care. (*c*) Orchard methods in the application of the various materials used, with the important considerations for spraying each fruit and for combating each orchard pest. This course is designed especially to familiarize the student with the practical details of actual spraying work in the orchard. Spray materials are prepared, spraying apparatus is examined and tested, old pumps are overhauled and repaired, and the actual spraying is done in the college orchards and small-fruit plantations.

1 class hour. 2 2-hour laboratory periods, credit, 3.
Assistant Professor Drain.

Prerequisite, Pomology 53.

75. **I.** Systematic Pomology. — For juniors and seniors. A continuation of course 54, with special reference to nursery variety certification, variety study of pears, grapes, plums, cherries, strawberries, raspberries, blueberries, and blackberries.

1 class hour. 3 2-hour laboratory periods, credit, 4.
Laboratory fee, $4.00. Assistant Professor Drain.
Prerequisite, Pomology 54.

77. **I.** Commercial Pomology. — For seniors. The picking, handling, storing, and marketing of fruits, including a discussion of storage houses, fruit packages, and methods of grading and packing. Special emphasis is placed upon laboratory and field work, where the student is given actual practice in the picking and packing of most of the principal fruits.

1 class hour. 2 2-hour laboratory periods, credit, 3.
Mr. Roberts.

Prerequisite, Pomology 53.

80. **I.** 81. **II.** 82. **III.** Seminar. — For seniors majoring in pomology. Advanced study of problems relating to the business of fruit growing. Each student is assigned a major problem in lines of work in which he is particularly interested. He pursues his studies both by reading and research, and the materials obtained will be worked into theses, which are presented to the seminar for discussion. No lectures are given, but seminar meetings are held for one period each week.

1 class hour. Credit, 1.
The Department.

83. **II.** Geography and Economic Problems of the Fruit Industry. — For seniors; juniors may elect. This course considers the leading American and foreign centers of fruit production as they affect our own fruit industry through competition here or abroad. Particular reference is made to the economic position of fruit growing in New England and to the major factors influencing the industry here. The distribution of production costs in New England is studied with relation to costs in other regions and to the details of orchard management.

3 class hours. Credit, 3.
Professor Van Meter.

Prerequisite, Pomology 53.

84. **II.** Advanced Pomology. — For seniors. A critical survey of the scientific principles underlying orchard practices, with especial attention to recent research work in fruit growing. Textbooks, lectures, assigned readings, and field exercises.

2 class hours. 1 2-hour laboratory period, credit, 3.
Professor Sears and Mr. Roberts.

Prerequisite, Pomology 53.

85. **III.** Advanced Pomology. — For seniors. As stated under Course 84.

3 class hours. Credit, 3.
Professor Sears and Mr. Roberts.

Prerequisite, Pomology 84.

DIVISION OF PHYSICAL AND BIOLOGICAL SCIENCES.

Professor Gordon.

Bacteriology and Physiology.

Professor Gage, Assistant Professor Bradley, Miss Garvey.

The courses in bacteriology and physiology have been planned to furnish: (1) general training in these subjects for all college students, (2) training for those interested in agriculture, industries, and domestic science, (3) training for prospective students of human or veterinary medicine and public health, (4) training for teachers and laboratory workers in the biological sciences. The courses in bacteriology include introductory and general courses, and advanced work, most of which precedes the applied bacteriology of agriculture, the arts, industry, domestic science, and public health. The course in physiology includes considerations of modern ideas on this subject in relation to human welfare.

Bacteriology.

Elective Courses.

30. **II.** Introductory and General Bacteriology. — For sophomores, juniors, and seniors. Designed to make micro-organisms real and significant. An attempt is made to demonstrate their wide distribution and relationship to agriculture, arts, science, industries, and medicine. The course aims to provide an elementary basis for bacteriological study and interpretation and to furnish such material as will be valuable in understanding agriculture, domestic science, and public health problems.

2 3-hour laboratory periods, credit, 3.

Laboratory fee, $5.00. Assistant Professor Bradley and Miss Garvey.

51. **III.** Differential Bacteriology. — For juniors; seniors may elect. Morphological, cultural, and physiological aspects of micro-organisms are considered. Types of bacteria, their classification and identification, and their functions are studied. This course is fundamental to all advanced and extended microbiological studies.

2 3-hour laboratory periods, credit, 3.

Laboratory fee, $5.00. Professor Gage and Miss Garvey.

Prerequisite, Bacteriology 30 or 50.

60. **I.** Public Health. — For juniors; seniors may elect. Considers the relation of the human body to its environment in the maintenance of health and the production of disease. This study is based upon human anatomy and physiology. The individual, as a member of society, governed by natural laws, is also of fundamental importance. Animal and human diseases of public health significance are reviewed, their control considered, and their social values discussed.

3 class hours. Credit, 3.

Professor Gage.

61. **II.** Public Health. — For juniors; seniors may elect. Public health laws, organization, and the laboratory in relation to public health projects will be discussed. Vital statistics and their significance will be considered.

3 class hours. Credit, 3.

Professor Gage.

Prerequisite, Bacteriology 60.

62. **III.** Public Health. — For juniors; seniors may elect. Sanitation and its relation to agriculture and public health. The microbiological features of air, water, soil, sewage, refuse, and the control of municipal and rural sanitary projects will be considered.

3 class hours. Credit, 3.

Assistant Professor Bradley.

Prerequisite, Bacteriology 61.

75. **I.** Advanced Bacteriology. — For seniors; juniors may elect. This course will include advanced studies in the differentiation of micro-organisms, including serology as applied to classification and diagnosis. This course prepares for the study of more advanced agricultural, domestic science, and public health problems.

10 laboratory hours, credit, 5.
Laboraotry fee, $5.00. Professor Gage and Miss Garvey.
Prerequisite, Bacteriology 51.

82. **I.** Soil Bacteriology. — For seniors; juniors may elect. Such subjects as the number and development of micro-organisms in different soils; the factors which influence their growth; food, reaction, temperature, moisture, and aeration; the changes wrought upon inorganic and organic matter in the production of soil fertility, ammonification, nitrification, and denitrification; fixation of nitrogen symbiotically and non-symbiotically; methods of soil inoculation receive attention.

2 3-hour laboratory periods, credit, 3.
Laboratory fee, $5.00. Assistant Professor Bradley and Miss Garvey.
Prerequisite, Bacteriology 50.

81. **II.** Food Bacteriology. — For seniors; juniors may elect. A study of the principles of food preservation and food conservation by means of drying, canning, refrigerating, and addition of chemicals. Food fermentations, as illustrated by bread, vinegar, etc., are examined. Decomposition of foods, as may be seen in meat, oysters, fish, milk, etc., as well as diseased and poisonous foods, receive consideration. Contamination of food supplies by means of water, sewage, handling, exposure, diseased persons, etc., is of especial significance and is demonstrated by laboratory exercises. Laboratory inspection of foods is now a subject of great import and is given attention.

2 3-hour laboratory periods, credit, 3.
Laboratory fee, $5.00. Assistant Professor Bradley and Miss Garvey.
Prerequisite, Bacteriology 50.

80. **III.** Dairy Bacteriology. — For seniors; juniors may elect. Special emphasis is placed upon milk supplies. The microbial content of milk, its source, its significance, its control; microbial taints and changes in milk; groups or types of organisms found in milk; milk as a carrier of disease-producing organisms; the value of clarification, centrifugal separation, temperature, pasteurization; the abnormal fermentations of milk; bacteriological milk standards and their interpretation; ripening of milk and cream; the bacterial content of butter; a survey of the microbiology of cheeses; a study of special dairy products, such as ice cream and artificial milk drinks.

2 3-hour laboratory periods, credit, 3.
Laboratory fee, $5.00. Assistant Professor Bradley and Miss Garvey.
Prerequisite, Bacteriology 50.

Physiology.

Elective Courses.

33. **III.** Physiology. — For sophomores; juniors and seniors may elect. This course presents the subject of physiology from the standpoint of its definition and modern scope. It includes a plan of theoretical demonstrational and practical work to illustrate the inter-relation of the chemical, physical, and biological sciences with functional and behavioristic aspects of life. The course is suited to the needs of students who elect only one course in physiology, but students who complete it may continue the subject in a more advanced course.
2 class hours. 1 2-hour laboratory period, credit, 3.
Professor Gage.

63. **I.** Physiology. — For juniors; seniors may elect. The object of this course is to adapt the elements of physiology to the modern viewpoint. The relationship and influence of experimental biology, physical chemistry, bio-

chemistry and instruments of precision upon physiology are considered. It is planned as an introductory course for those who wish to do more advanced work in the subject. Applications and demonstrations will be made of the practical side of nutrition, circulation, exercise, mental work, fatigue, and neuro-muscular activity as they relate to the conservation of human and animal life.
2 class hours. 1 2-hour laboratory period, credit, 3.
Professor GAGE.

64. **II.** PHYSIOLOGY. — For juniors; seniors may elect. Physiology of nutrition with special reference to intermediate and basal metabolism. Introductory work on nerves and nerve action, and a more detailed consideration of internal and external respiration.
2 class hours. 1 2-hour laboratory period, credit, 3.
Professor GAGE.

Prerequisite, Physiology 33 or 63.

65. **III.** PHYSIOLOGY. — For juniors; seniors may elect. Physiology of the circulation, absorption, and excretion, with special reference to gross and microscopic anatomy. This course is especially planned for students who expect to major in subjects pertaining to plant and animal life.
2 class hours. 1 2-hour laboratory period, credit, 3.
Professor GAGE.

Prerequisite, Physiology 64.

Botany.

Professor OSMUN, Associate Professor CLARK, Assistant Professor TORREY, Assistant Professor DAVIS, Mr. CANIS, Mr. VAN VECHTEN.

The required courses in botany are planned to present a knowledge of the principles of plant life both for their fundamental importance in agriculture and for their general educational value. Elective courses are of two types: (1) those which have for their chief aim the direct support of technical courses in agriculture and horticulture, and (2) those providing broader, more intensive training in the science. Courses in the second group may lead to specialization in the field. They also furnish excellent training for those specializing in other sciences and in scientific agriculture. In all undergraduate courses the relation of the science of botany to agriculture is emphasized.

Required Courses.

[Courses 3 and 25 constitute a general elementary course in the botany of higher plants, and are required of all students; Course 26 is advised for all who intend to study further in the department.]

3. **III.** INTRODUCTORY BOTANY. — For freshmen. Presents the seed plants as plastic organisms molded by their environment. Also introduces the student to methods of identifying and classifying plants.
2 class hours, 2 2-hour laboratory periods, credit, 4.
Laboratory fee, $1.50.
Assistant Professor TORREY and Associate Professor CLARK.

25. **II.** INTRODUCTORY BOTANY. — For sophomores. The anatomy and physiology of seed plants (Phanerogamia).
1 class hour. 2 2-hour laboratory periods, credit, 3.
Laboratory fee, $1.50.
Prerequisite, Botany 3.
Assistant Professor TORREY and Associate Professor CLARK.

Elective Courses.

26. **III.** CRYPTOGAMIC BOTANY. — For sophomores; juniors and seniors may elect. Selected forms typifying the slime-molds, bacteria, blue-green and green algae, fungi and lichens. The course has a two-fold purpose: (1) it is intended for students who desire to extend their knowledge to the principal branches of the plant kingdom, thus rounding out a general course of which

Botany 3 and 25 constitute the first two parts; (2) it is also planned as an introduction to the study of plant diseases by those students who expect to enter some branch of plant industry.

1 class hour. 2 2-hour laboratory periods, credit, 3.
Laboratory fee, $1.50. Professor Osmun.
Prerequisite, Botany 25.

50. **I.** Cryptogamic Botany. — For juniors; seniors may elect. This course continues the work of Botany 26, dealing with the brown and red algae, liverworts, mosses and fernworts.

1 class hour. 2 2-hour laboratory periods, credit, 3.
Laboratory fee, $1.50. Professor Osmun.
Prerequisite, Botany 26.

51. **I.** Diseases of Vegetables (1930–31).—For juniors and seniors. Study of the principal diseases of vegetables occurring in field and greenhouse, with especial attention to those important in Massachusetts, and consideration of combative measures. This course is planned and conducted primarily for students interested in vegetable gardening, but those intending to enter any branch of plant industry should find it of interest. Students who desire to extend their knowledge of plant diseases over a wider range of crops, may do so by taking, in addition to this, any or all of Courses 52, 53, and 54. Given in alternate years.

1 class hour. 2 2-hour laboratory periods, credit, 3.
Laboratory fee, $1.50. Assistant Professor Davis.

52. **I.** Diseases of Fruits (1931–32). — For juniors and seniors. The plan of this course is similar to that of Course 51 but it is intended primarily for students interested in pomology. Given in alternate years.

1 class hour. 2 2-hour laboratory periods, credit, 3.
Laboratory fee, $1.50. Assistant Professor Davis.

53. **II.** Diseases of Field Crops (1930–31). — For juniors and seniors. The plan of this course is similar to that of Course 51 but it is intended primarily for students interested in field crops. Given in alternate years.

1 class hour. 2 2-hour laboratory periods, credit, 3.
Laboratory fee, $1.50. Assistant Professor Davis.

54. **II.** Diseases of Floricultural Crops, Ornamentals, Shrubs, and Trees (1931–32). — For juniors and seniors. The plan of this course is similar to that of Course 51 but it is intended primarily for students interested in floriculture, nursery practice and forestry. Given in alternate years.

1 class hour. 2 2-hour laboratory periods, credit, 3.
Laboratory fee, $1.50. Assistant Professor Davis.

55. **III.** Diseases of Crops (1930–31). — For juniors and seniors. This is a general course in which representative diseases of the principal crops grown in Massachusetts are studied. The plan of the course is otherwise similar to that of Course 51. It is intended for students majoring in entomology and others who desire a brief, general course of this nature.

1 class hour. 2 2-hour laboratory periods, credit, 3.
Laboratory fee, $1.50. Assistant Professor Davis.

56. **I.** Microtechnique. — For juniors and seniors. A course in the preparation of microscopic mounts including the celloidin and paraffin methods and involving the use of microtomes and of differential stains.

3 2-hour laboratory periods, credit, 3.
Laboratory fee, $3.00. Assistant Professor Torrey.

58. **I.** 59. **II.** 60. **III.** Systematic Botany of the Higher Plants (1930–31). — Alternate with Courses 61, 62, and 63. For juniors and seniors.

An intensive study of gymnosperms and angiosperms. Lectures deal with the interrelations of the flowering plants and with their ecology, distribution, and economic importance. Laboratory work consists of a critical study of types from the most important natural plant families. Particular emphasis is laid on the flora of Massachusetts. The department herbarium and greenhouses supply material of important tropical forms for study.

2 class hours. 1 2-hour laboratory period, credit, 3.
Laboratory fee, $1.50 per term. Assistant Professor TORREY.

61. **I.** 62. **II.** 63. **III.** THE COMPARATIVE ANATOMY OF GREEN PLANTS (1931–32). — Alternate with Courses 58, 59, and 60. For juniors and seniors. In the lectures an intensive study is directed to the comparative anatomy of green plants from the evolutionary standpoint. Particular emphasis is laid upon the woody forms both living and extinct. Of the latter, the department is fortunate in possessing excellent sets of micro-preparations and lantern slides.

2 class hours. 1 2-hour laboratory period, credit, 3.
Laboratory fee, $1.50 per term. Assistant Professor TORREY.
Prerequisite, Botany 26.

75. **I.** 76. **II.** 77. **III.** PLANT PATHOLOGY. — For seniors. Comprehensive study of diseases of plants; training in laboratory methods and technique, including culture work and artificial inoculation of hosts; miscellaneous diagnosis; study of literature and representative life histories of pathogens. Prepares for civil service, experiment station, and college work.

1 class hour. 4 2-hour laboratory periods, credit, 5.
Laboratory fee, $3.00 per term. Professors OSMUN and DAVIS.
Prerequisite, botany 26.

78. **I.** PLANT PHYSIOLOGY. — For seniors. Study of the factors and conditions of (*a*) plant nutrition, including the taking up of water and mineral substances, the assimilation of carbon and nitrogen, and the release of energy due to the processes of dissimilation; (*b*) plant growth, including the influence of internal and external factors on growth, the development of reproductive and vegetative organs; (*c*) plant movements, including those due to the taking up of water, and those of both motile and fixed forms in response to external stimuli. Weekly conferences are held, at which students report on assignments to original sources in the literature.

2 class hours. 3 2-hour laboratory periods, credit, 5.
Laboratory fee, $3.00. Associate Professor CLARK.
Prerequisites, Botany 26; Chemistry 51.

79A. **II.** 80A. **III.** PLANT PHYSIOLOGY. — For seniors. As stated under Course 78.

2 class hours. 3 2-hour laboratory periods, credit, 5.
Laboratory fee, $3.00 per term. Associate Professor CLARK.
Prerequisite, Botany 78.

79B. **II.** 80B. **III.** PLANT PHYSIOLOGY. — For seniors; juniors may elect. A briefer course than Botany 78, 79A, 80A, designed especially for students in horticulture, agronomy, and floriculture, and aiming to give the underlying principles of plant physiology which will supply the scientific basis for the manifold practices in the various fields of plant culture.

2 class hours. 1 2-hour laboratory period, credit, 3.
Laboratory fee, $1.00 per term. Associate Professor CLARK.
Prerequisite, Botany 25 or Chemistry 30.

81. **I.** PLANT ECOLOGY. — For seniors. Study of plants in relation to their environment, with special emphasis on the newer field studies, which have given increasing insight into the physical and chemical factors as they influence growth and development in the field and the adaptability of plants to changes

in their normal environment. The various types of plant formations and successions are studied, as well as the mutual and antagonistic relations of certain plants.

2 class hours. 1 2-hour laboratory period, credit, 3.
Laboratory fee, $1.00. Associate Professor Clark.
Prerequisite, Botany 26.

Chemistry.

Professor Chamberlain, Professor Peters, Assistant Professor Serex, Mr. Cupery.

In teaching the courses in chemistry, emphasis is laid on both their educational and their vocational value. The courses in the freshman year deal with fundamental principles and give the student such an understanding of the subject as will enable him to appreciate the relation of chemistry to agriculture. The more advanced courses, including quantitative analysis, organic, physiological, and physical chemistry, are for those who intend to become teachers and workers in the allied sciences, or who desire to follow agricultural chemistry as a vocation. Those completing the undergraduate courses are fitted for positions in the agricultural industries — fertilizer, feed, and insecticide manufacture — as well as in other lines of industry, and in the State experiment stations, in commercial laboratories, and in high school teaching. Postgraduate students are prepared for positions as teachers in colleges, and for more advanced positions in industry and in the experiment stations.

Required Courses.

1. **I.** 2. **II.** General Chemistry. — For freshmen who do not present chemistry for entrance and who begin the subject in college. It presents an introduction to the fundamental chemical laws, together with a study of the typical acid- and base-forming elements and their compounds. The second term contains some of the material given in Courses 4 and 5.

2 class hours. 2 2-hour laboratory periods, credit, 4.
Laboratory fee, $3.00 per term. Mr. Cupery.

4. **I.** Advanced General Chemistry. — For freshmen who present chemistry for entrance. A review of general chemistry centered, for the most part, about the laboratory work, which takes the synthetic form. Substances of agricultural importance are prepared in quantity and studied in detail by the student. These include ammonium sulfate, superphosphate, muriate and sulfate of potash, arsenate of lead, Paris green, Bordeaux mixture, lime-sulfur, and emulsions.

2 class hours. 2 2-hour laboratory periods, credit, 4.
Laboratory fee, $3.00. Professor Peters.
Prerequisite, Entrance Chemistry.

5. **II.** Inorganic Agricultural Chemistry. — A continuation of Course 4, for freshmen who present chemistry for entrance. A study of the chemical composition, properties, and reactions of soils, fertilizers, fungicides, and insecticides. The laboratory work is divided into three parts: (*a*) qualitative examination of soil, plant ash, and superphosphate; (*b*) approximate quantitative determination of moisture, ash, carbonic acid, phosphoric acid, potash, nitrogen, etc., in farm crops, soils, and fertilizers; (*c*) special work on retention of salts by soil, leaching of lime from the soil by carbonated water, etc.

2 class hours. 2 2-hour laboratory periods, credit, 4.
Laboratory fee, $3.00. Assistant Professor Serex.
Prerequisite, Chemistry 4.

Elective Courses.

25. **I.** Qualitative Analysis. — *Basic.* — For sophomores. The systematic analysis of metallic salts, presented from the ionic viewpoint. A close study of the tests used in the separation and identification of the metals, and

the application of these tests to unknown mixtures. This course should be taken by all intending to follow chemistry as a vocation.
1 class hour. 2 2-hour laboratory periods, credit, 3.
Laboratory fee, $4.00. Assistant Professor Serex.
Prerequisite, Chemistry 2 or 5.

26. **II.** Qualitative Analysis. — *Acidic.* — For sophomores. A continuation of Course 25.
1 class hour. 2 2-hour laboratory periods, credit, 3.
Laboratory fee, $4.00. Assistant Professor Serex.

29. **I.** Qualitative Agricultural Chemistry. — For sophomores. Embraces a study of the important inorganic elements in plant life, the atmosphere, water, soil and its formation, fertilizers, insecticides and fungicides. The laboratory work will be qualitative in nature, dealing with substances utilized in agriculture. This course should not be taken by those intending to follow chemistry as a vocation or as a pre-medical requirement.
2 class hours. 1 2-hour laboratory period, credit, 3.
Laboratory fee, $3.00. Assistant Professor Serex.
Prerequisite, Chemistry 2 or 5.

30. **II.** Organic Agricultural Chemistry. — For sophomores; juniors and seniors may elect. Embraces the study of the most important groups of organic compounds of plants and animals, the composition of plants, the chemistry of plant growth, plants as food and as industrial material, the composition of animals, the chemistry of digestion, also the study of some of the products related to plants and animals, such as milk, butter, cheese, sugar, and alcohol. The treatment of the subject is general, avoiding (so far as possible) complicated chemical facts and relationships, and endeavoring simply to make the student acquainted with the general chemistry of plants and animals and agricultural processes and products.
3 class hours. Credit, 3.
Professor Chamberlain.

51. **I.** 52. **II.** 53. **III.** Organic Chemistry. — For juniors; seniors may elect. A systematic study, both from texts and in the laboratory, of the more important compounds in the entire field of organic chemistry. Especial attention is given to those compounds which are found in agricultural products or are manufactured from them. These include alcohols, acids, esters, fats, carbohydrates, and proteins. In the third term compounds in the benzene series are considered. The work forms a foundation for courses in physiological chemistry and agricultural analysis, and is especially planned for those majoring in chemistry or the other sciences.
3 class hours. 2 3-hour laboratory periods, credit, 6.
Laboratory fee, $5.00 per term. Professor Chamberlain.
Prerequisite, Chemistry 2 or 5. Chemistry 26 is prerequisite for those majoring in chemistry.

61. **I.** Quantitative Analysis. — For juniors; seniors may elect. The course includes the gravimetric determination of chlorides, sulfates, iron; the volumetric analysis of acids and bases; and the dichromate method for iron.
1 class hour. 2 4-hour laboratory periods, credit, 5.
Laboratory fee, $5.00. Professor Peters.
Prerequisite, Chemistry 25. Chemistry 26 is prerequisite for those majoring in chemistry.

62. **II.** For juniors; seniors may elect. A continuation of Course 61. A study of potassium permanganate as a volumetric reagent; limestone is analyzed; phosphorus is determined in soil; and the perchlorate method for potash is carried out. Analytical problems are a part of the work.
2 class hours. 2 4-hour laboratory periods, credit, 6.
Laboratory fee, $5.00. Professor Peters.

63. **III.** For juniors; seniors may elect. A continuation of Course 62. A study of the oxidation reactions of iodin and the precipitating reactions of thiocyanate; the analysis of Paris green and lead arsenate. The work closes with water analysis. By means of assigned readings, students are shown the importance of library work.
1 class hour. 2 4-hour laboratory periods, credit, 5.
Laboratory fee, $5.00. Professor Peters.

75. **I.** Physical Chemistry. — For seniors. A study of the fundamental theories and laws of physical chemistry, together with laboratory work which includes the important methods of physicochemical measurements.
3 class hours. 6 laboratory hours, credit, 6.
Laboratory fee, $5.00. Assistant Professor Serex.
Prerequisite, Chemistry 61.

80. **I.** Physiological Chemistry.—For seniors. Supplementary to Courses 51, 52, and 53. For those who expect to take up scientific work in microbiology, botany, agronomy, animal husbandry, etc., and who have had Courses 51, 52, and 53, it gives acquaintance with the chemistry of the physiological processes in plants and animals, by means of which some of the important organic compounds studied in Courses 51, 52, and 53 are built up in the living organism or are used as food by it. In the lectures, the study of food and nutrition as related to both human and domestic animals is the principal subject. In the laboratory, experimental studies are made of the animal body and of the processes and products of digestion, secretion, and excretion.
3 class hours. 2 2-hour laboratory periods, credit, 5.
Laboratory fee, $4.00. Mr. Cupery.

81. **II.** Food Analysis. — For seniors. Primarily the analytical study of milk and butter. May also include the analysis of other food stuffs for nutritive value or for impurities.
1 class hour. 2 4-hour laboratory periods, credit, 5.
Laboratory fee, $5.00. Mr. Cupery.
Prerequisite, Chemistry 61.

86. **II.** Review of General Chemistry. — For seniors. Primarily for students majoring in chemistry; others may elect by permission of the instructor. A knowledge of physical chemistry is desirable. The review of general chemistry is largely theoretical. Some subjects may be enlarged by special lectures, such as atomic structure, Werner's co-ordination theory, crystal structure as shown by X-rays.
3 class hours. Credit, 3.
Professor Peters.

87. **III.** History of Chemistry. — For seniors. An historical and biographical study of chemistry and chemists. The aim of the course is: (1) to give the student a comprehensive view of the science as a whole, through a study of the development of new ideas and the establishment of new theories and laws; and (2) to arouse an enthusiastic interest in the subject and an appreciation of the true spirit of scientific research, through a sympathetic presentation of the work and lives of the great chemists who have been the creators of the chemistry of today. The course will consist of lectures, supplemented by systematic correlated reading and the preparation of reports or essays.
3 class hours. Credit, 3.
Professor Chamberlain.

90. **II.** 91. **III.** Special Work in Chemical Problems. — For seniors. An assignment is made to each student, and he is expected to learn how research is done. The problem may be in analytical, general, agricultural, or industrial chemistry, and is to be continued for two terms.
1 class hour. 8 laboratory hours, credit, 5.
Laboratory fee, $5.00 per term. Professor Peters.

92. II. 93. III. Special Work in Organic Chemistry. — For seniors. In this course, as in Courses 90 to 97, the student may give his attention primarily to one line of chemical study for the purpose of becoming acquainted with methods of research. To those whose tastes and interests are in connection with the organic problems of agricultural chemistry, many subjects of study present themselves, among which may be mentioned: proteins, carbohydrates, fats; organic nitrogenous compounds in fertilizers and soils, and their relation to plants; the commercial production of alcohol from agricultural products; dyes, synthetic medicines, perfumes, etc.

1 class hour. 8 laboratory hours, credit, 5.
Laboratory fee, $5.00 per term. Professor Chamberlain.
Prerequisites, Chemistry 51, 52, 53, and 80.

94. II. 95. III. Special Work in Physical Chemistry. — For seniors. The field of agricultural chemistry offers many problems that have been attacked through the methods of physical chemistry; such, for example, are the hydrolysis of salts and of minerals and the absorption of salts and fertilizers by soils. This course is designed to familiarize the student with the literature on a special topic, and to give an insight into the methods of research. Each student selects one line of work and follows it through the course, repeating some of the original work. Students interested in colloid chemistry may make a brief study of fundamentals during the first term of this course, with the ultimate object of selecting a problem along this line for the second term.

1 class hour. 8 laboratory hours, credit, 5.
Laboratory fee, $5.00 per term. Assistant Professor Serex.
Prerequisite, Chemistry 75.

96. II. 97. III. Special Work in Physiological and Food Chemistry. — For seniors. An opportunity for those so interested to pursue the study of some physiological or food problem. This course is intended to familiarize the student with the nature of research under the careful supervision of the instructor. The problems of physiological chemistry are of a varied and interesting character.

1 class hour. 8 laboratory hours, credit, 5.
Laboratory fee, $5.00. Mr. Cupery.
Prerequisite, Chemistry 80.

Entomology, Zoology, and Geology.

Professor Gordon, Professor Alexander, Professor Crampton, Assistant Professor Sweetman, Assistant Professor Farrar, Assistant Professor Grannis, Miss Morse.

Courses in entomology are for two purposes: (1) the introductory courses aim to give the students a general knowledge of insects, particularly in their relations to man, his crops, his domestic animals, and his health. (2) Later courses are intended to train students desiring to specialize in entomology to become United States, State, or experiment station entomologists, teachers, foresters, tree wardens, entomologists connected with insecticide-manufacturing companies, consulting entomologists, or to occupy other positions where an expert knowledge of insects is called for. The beekeeping courses are offered with the following aims: (1) To meet the increase in vocational opportunities for the production of bees or honey as a business. (2) To study the beekeeping needs of fruit and truck-crop industries and the part that bees play in pollinating flowers. (3) To acquaint the student with a recreational field of many phases, which can be made profitable.

The undergraduate courses in zoology are essentially introductory in character and lay stress on basic principles. Students majoring in biological science, and others properly qualified, may arrange for supplementary studies of a more advanced or special nature.

Entomology.

Elective Courses.

26. II. General and Economic Entomology. — Primarily for sophomores intending to major in one of the biological sciences; other sophomores, juniors,

and seniors may elect. For students who desire some knowledge of insects but who cannot give more than one term to the subject; also an introduction to the later courses for those who intend to follow entomology further. Touches briefly upon the structure of insects, so far as this is needed for such a course; deals with metamorphosis and classification to the larger groups, and discusses the most important methods and materials used for control. The greater part of the time is devoted to special study of the most important insect pests, particularly of New England, showing their modes of life, the injuries they cause, and the best methods of control. In this way the most serious pests of fruit trees, ornamental trees and shrubs, market-garden and green-house crops, field crops, animals, and man are treated.

3 class hours. Credit, 3.

Professor Alexander.

28. **III.** Field Studies in Entomology. — For sophomores intending to major in one of the biological sciences; other sophomores, juniors, and seniors admitted by permission of instructor in charge. Three class-room exercises to about May 1; thereafter three field exercises per week. In the field the work of insects found will be studied and a collection of insects made. Methods of collecting, preparing, and mounting insects for collections will be taught. In the class room, until about May 1, studies preparatory to the field work will be given. Class limited.

3 class hours to about May 1; thereafter, 3 2-hour laboratory periods, credit, 3.

The Department.

Prerequisite, Entomology 26.

50. **I.** Pests of Special Crops. — For juniors and seniors not majoring in entomology. The laboratory work is largely individual in this course. Students majoring in subjects other than entomology, who desire a more complete knowledge of the insects connected with their major lines of work, can obtain it through this course. Work consisting of a careful study of the important economic insect pests leads to an ability to recognize their different stages, and their work, and to a knowledge of the best methods for their control. Work of this kind is available on the insects attacking field crops, market-garden crops, tree fruits, small fruits, shade trees and shrubs, forest trees, flowers, the domestic animals, household articles, and man. This course can also be begun or continued in the winter term as Course 51.

3 2-hour laboratory periods, credit, 3.

Laboratory fee, $1.00. Assistant Professor Farrar.

Prerequisite, Entomology 26.

51. **II.** Pests of Special Crops. — For juniors; seniors may elect. Individual laboratory work in the more important insect pests in this country and the preparation and presentation of bulletin material on them.

3 2-hour laboratory periods, credit, 3.

Laboratory fee, $1.00. Assistant Professor Farrar.

Prerequisite, Entomology 26.

52. **I.** Classification of Insects. — For juniors specializing in entomology. Laboratory work on the identification and classification of insects of various groups.

2 2-hour laboratory periods, credit, 2.

Laboratory fee, $1.00. Professor Alexander.

Accompanying Entomology 53.

53. **I.** Insect Morphology. — For juniors specializing in entomology, and for other juniors or seniors having the prerequisite. The lectures treat of the external and internal anatomy of insects, particularly those parts used in identification, a knowledge of which is needed in the accompanying Course 52. In the laboratory the external anatomy of the most important groups is studied,

with emphasis on the characters used in learning the names of insects, and on the methods of using analytical keys.
2 class hours. 3 2-hour laboratory periods, credit, 5.
Laboratory fee, $1.00. Professor CRAMPTON.
Prerequisite, Entomology 26.

55. **II.** CLASSIFICATION OF INSECTS. — Continuation of Course 52.
2 2-hour laboratory periods, credit, 2.
Laboratory fee, $1.00. Professor ALEXANDER.

57. **III.** CLASSIFICATION OF INSECTS. — Continuation of Course 55.
2 2-hour laboratory periods, credit, 2.
Laboratory fee, $1.00. Professor ALEXANDER.

58. **II.** MEDICAL ENTOMOLOGY. — For juniors. Diseases of man, animals, and plants transmitted by insects and other arthropods.
1 class hour. 1 2-hour laboratory period, credit, 3.
Professor CRAMPTON.

59. **II.** INSECT PHYSIOLOGY. — For juniors. A consideration of the organs of the insect body and their functions, with especial reference to respiration and nutrition; the relationship of physiology to behavior, biochemistry and biophysics.
3 class hours. Credit, 3.
Assistant Professor SWEETMAN.

75. **III.** FOREST AND SHADE-TREE INSECTS. — For juniors; seniors may elect. The lecture work deals with the principles and methods of controlling insects which attack forests and forest products, shade trees, etc. The laboratory periods are devoted to a study of the more important species, their identification, biology, and specific control measures. Field work supplements laboratory study if time permits. One entire Saturday for field excursion is also required.
1 class hour. 3 2-hour laboratory or field periods, credit, 4.
Laboratory fee, $2.00. Professor ALEXANDER.
Prerequisite, Entomology 26; 52 and 53 desirable.

76. **I.** ADVANCED ENTOMOLOGY. — For seniors. Studies on internal anatomy and organology of insects; a study of arthropods other than insects.
1 class hour. 1 2-hour laboratory period, credit, 2.
Laboratory fee, $1.50. Professor CRAMPTON.

77. **II.** ADVANCED ENTOMOLOGY. — For seniors. Studies of the life history, habits, and methods of control of the important insect pests of the United States; recognition tests of these pests, and an examination of the literature on them; methods of bulletin preparation.
3 2-hour laboratory periods, credit, 3.
Laboratory fee, $1.00. Professor ALEXANDER.
Prerequisite, Entomology 76.

78. **III.** ADVANCED ENTOMOLOGY. — For seniors. Immature stages of insects.
1 class hour. 1 2-hour laboratory period, credit, 2.
Laboratory fee, $1.00. Professor CRAMPTON.

79. **I.** INSECTICIDES AND THEIR APPLICATION. — For seniors; juniors may elect. Lectures on the composition, preparation, and methods of application of insecticides; other control measures.
3 class hours. Credit, 3.
Assistant Professor SWEETMAN.
Prerequisite, Entomology 26.

80. **I.** INSECT ECOLOGY. — For seniors. The relation of the insect to its environment, covering the topics: definitions, present status of the subject, factors of environment such as temperature, moisture, light, etc., and their effect;

the biotic potential; environmental resistance; ecological succession; aquatic and terrestrial insect communities; applied ecology.
3 class hours. Credit, 3.
Assistant Professor Sweetman.

Prerequisite, Entomology 57.

81. **II.** Biological Control. — For seniors. The topics treated in this course include types of parasitic organisms; insect diseases; other organisms as parasites of insects; insect parasites; predators; the natural ecological status of insect parasitism and the economic status of parasites.
3 class hours. Credit, 3.
Assistant Professor Sweetman.

Prerequisite, Entomology 80.

82. **III.** Insectary Practice. — For seniors majoring in entomology. In the class exercises, consideration is given to the methods, practices, and apparatus used in life history studies. The laboratory exercises illustrate the uses and applications of the above through the medium of simple life history problems.
1 class hour. 2 2-hour laboratory periods, credit, 3.
Assistant Professor Sweetman.

Prerequisite, Entomology 81.

83. **I.** Advanced Entomology. — For seniors. Scale insects, their structure, habits; methods of mounting; identification.
1 class hour. 2 2-hour laboratory periods, credit, 3.
Laboratory fee, $1.50. Professor Alexander.

84. **III.** Advanced Entomology. — For seniors. Classification of the minor orders of insects.
1 class hour. 1 2-hour laboratory period, credit, 2.
Laboratory fee, $1.00. Professor Alexander.

90. **II.** Evolution. — For seniors; juniors may elect. In order to demonstrate the universal scope and operation of the laws of evolution, the course includes a brief sketch of the probable origin and evolution of matter as viewed in the light of modern physical and chemical research; the evolution of the solar system, leading to the formation of the earth; the changes in the earth, preparatory to the production of life; the physical and chemical basis of life; the probable steps in the formation of living matter, and the theories concerning it; the evolution of living things; the developmental history of man, and of the races of mankind; the evolution of human intelligence, languages, culture, institutions, etc., and man's probable future in the light of his past development. Especial consideration is given to the factors of evolution, the basic principles of heredity, variation, and similar topics, with particular reference to their application to human welfare; and the recent contributions in the field of entomology to the advancement of our knowledge of these fundamental principles are briefly reviewed.
3 class hours. Credit, 3.
Professor Crampton.

Beekeeping.

Elective Courses.

65. **III.** Introductory Beekeeping. — For juniors; seniors may elect. A detailed study is made of the bee colony, including its organization, the life of its individuals in relation to the colony, and the cycle of the year. Attention is given to practical methods of managing colonies during the spring and early summer. Spring pollen, nectar flora, and the horticulturist's use and need of bees are other phases of the work covered. The laboratory work provides a study of beekeeping equipment; individual manipulation and an understanding of colony development is afforded. During the first half of the term a lecture is

substituted for one of the laboratory periods. To be complete, this course should be followed by Course 85.

1 class hour. 2 2-hour laboratory periods, credit, 3.
Assistant Professor FARRAR.

85. **I.** INTRODUCTORY BEEKEEPING. — For seniors. The work begun in Course 65 is continued for the completion of the beekeeping year, including late summer and fall management, wintering, and care and marketing of the crop. A more detailed study is made of regional differences, methods, and requirements for different types of honey production.

2 class hours. 1 2-hour laboratory period, credit, 3.
Assistant Professor FARRAR.

Prerequisite, Entomology 65.

86. **II.** ADVANCED BEEKEEPING. — For seniors. Advanced studies are made of important beekeeping problems, including anatomy and physiology; senses and bee behavior; soil and climatic factors influencing nectar secretion; kinds, importance, and distribution of pollen and nectar sources; bee disease control; marketing problems; queen rearing and commercial bee production. Parts of this work are made individual, depending on the needs of the student.

2 class hours. 1 2-hour laboratory period, credit, 3.
Assistant Professor FARRAR.

Prerequisite, Entomology 85.

ZOOLOGY.

Elective Courses.

26. **I.** ELEMENTS OF ZOOLOGY. — For sophomores; juniors and seniors may elect. This course consists of an elementary treatment of the principles of animal biology, and provides a measure of preparation for such subsequent studies as assume some acquaintance with the phenomena of animal life.

2 class hours. 1 2-hour laboratory period, credit, 3.
Laboratory fee, $2.00. The DEPARTMENT.

27. **II.** ELEMENTARY VERTEBRATE ZOOLOGY. — For sophomores; juniors and seniors may elect. This course deals with the structure of the vertebrate, and is adapted to the needs of prospective students in zoology, general biology, veterinary science, physiology, etc.

1 class hour. 2 2-hour laboratory periods, credit, 3.
Laboratory fee, $2.00. The DEPARTMENT.

28. **III.** FORMS OF INVERTEBRATE ANIMALS. — For sophomores; juniors and seniors may elect. This course is designed chiefly to afford a synoptic view of the main groups of non-vertebrated animals, and is intended for future students of entomology, zoology, and general biology.

1 class hour. 2 2-hour laboratory periods, credit, 3.
Laboratory fee, $3.00. The DEPARTMENT.

50. **II.** ELEMENTS OF MICROSCOPIC TECHNIQUE. — For juniors; seniors and graduate students may elect. Open to students upon consultation with the department. The course consists of a series of practical exercises in preparing animal tissues for microscopic examination, and a study of principles and methods involved in such work.

3 2-hour laboratory periods, credit, 3.
Laboratory fee, $5.00. The DEPARTMENT.
Prerequisite, Zoology 26.

65. **I.** 66. **II.** 67. **III.** COMPARATIVE INVERTEBRATE ZOOLOGY, OR COMPARATIVE VERTEBRATE ZOOLOGY. — For juniors, seniors, and graduate students. Students are admitted to these courses only upon consultation with the department. The work in both subjects is arranged to run through the year and comes at the same scheduled hours in each term; but the courses are separate, and, if both are desired, must be taken in alternate years. The spring term work in the

zoology of the vertebrates, 67. III., deals with mammalian anatomy (based on the cat), and the students who have not had vertebrate zoology, 65. I. and 66. II., may, upon consultation with the department, arrange to take vertebrate zoology, 67. III. The spring term work in invertebrate zoology, 67. III., deals chiefly with the arthropods, and students who have not had invertebrate zoology, 65. I. and 66. II., may, upon consultation with the department, arrange to take invertebrate zoology, 67. III.

1 class hour. 2 2-hour laboratory periods, credit, 3.
The Department.

Laboratory fee, $3.00 per term for those who pursue either course through the year; for those taking spring term only, the laboratory fee is $4.50.
Prerequisite, Zoology, 26.

75. **I.** 76. **II.** 77. **III.** Embryology. — For juniors, seniors and graduate students. Students are admitted to these courses only upon consultation with the department. The work in each term is more or less distinct, as explained below. Course 75. I. deals with the basic principles of development, heredity, and sex in animals, and is open to students who have had Zoology 26. Course 76. II. treats of the early stages of development of the chick, and is open to students who have previously taken or are pursuing work in comparative vertebrate zoology, and to qualified students who wish an introduction to the development of the chick in connection with their work in other departments. Course 77. III. deals with the development of the mammal and is open to students who have previously taken or are pursuing work in comparative vertebrate zoology and who have had Course 76. II.

1 class hour. 2 2-hour laboratory periods, credit, 3.
Laboratory fee, winter and spring terms only, $3.00 per term.
The Department.

Prerequisites, as stated above.

79. **III.** Ornithology. — For juniors; seniors and others may elect. The taxonomic characters, relationships, adaptive radiation, migrations, distribution, and habits of birds. Lectures, practical exercises in the museum, and studies in the field.

1 class hour. 2 2-hour laboratory periods, credit, 3.
Laboratory fee, $2.00. Professor Gordon.

85. **I.** 86. **II.** 87. **III.** Special Problems. — For seniors and graduate students. Seniors who are pursuing a major in biology, and graduate students who wish to take a minor in the department, may arrange for special work.
Credit, 3.
Laboratory fee, $3.00 per term. Professor Gordon.

Geology.

Elective Courses.

Each of the courses named below is distinct, so that a student may elect only one, or any two, or all three, in any sequence. For those who wish a year's work in geology, the desirable sequence is in the order given.

50. **I.** Elements of Petrology. — For juniors, seniors, and graduate students. This course deals with the rock-forming minerals and the various kinds of rocks, by means of lectures and laboratory studies, with discussions of the processes by which rocks are formed, and their modes of occurrence and structural features.

1 class hour. 2 2-hour laboratory periods, credit, 3.
Professor Gordon.

51. **II.** Dynamic and Physiographic Geology. — For juniors, seniors, and graduate students. A study of the work of the various agents that shape the surfaces of the lands. The history of the development of land forms.

1 class hour. 2 2-hour laboratory periods, credit 3.
Professor Gordon.

52. **III.** Historical Geology. — For juniors, seniors, and graduate students. A review of the more important events in the physical history of North America, and of the plants and animals of the past.
1 class hour. 2 2-hour laboratory periods, credit, 3.
Professor Gordon.

Mathematics and Civil Engineering.

Professor Ostrander, Professor Machmer, Assistant Professor Moore, Mr. Boutelle.

The work of the freshman year is required. It is intended to furnish the necessary drill and groundwork needed for many of the scientific and practical courses of other departments. Thoroughness and accuracy are insisted upon. The advanced work in mathematics is taught from a practical standpoint, and many of its applications to other subjects are given. The courses in surveying and civil engineering are given to furnish the groundwork for a professional career. Special emphasis is given to the subjects bearing on highway construction and maintenance.

Required Courses.

1. **I.** Higher Algebra. — For freshmen. A brief review of radicals, quadratic equations, ratio and proportion, and progressions; graphs, binomial theorem, summation of series, variation, determinants, permutations and combinations, logarithms, and theory of equations.
3 class hours. Credit, 3.
Professors Machmer, Moore, and Mr. Boutelle.

2. **II.** Plane Trigonometry. — For freshmen. The trigonometric functions as lines and ratios; proofs of the principal formulas, transformations; inverse functions, use of logarithms; the applications to the solution of right and oblique triangles; practical applications; trigonometric equations.
3 class hours. Credit, 3.
Professors Machmer, Moore, and Mr. Boutelle.

3. **III.** Mathematical Analysis. — For freshmen. A review of methods of computation, with special emphasis on short processes and the making of close approximations. A study of some of the different modes of variation; finding the exact or approximate relations (equations) between the varying quantities, particularly as illustrated by the use of the graph. Also a study of the properties of closed figures, such as polyhedra, cylinders, cones, and the sphere, and calculations of their surfaces and volumes. An effort is made to apply mathematical processes directly to the work given in the various technical departments of the college.
3 class hours. Credit, 3.
Professors Machmer, Moore, and Mr. Boutelle.

Elective Courses.

26. **II.** Plane Surveying. — For sophomores; juniors and seniors may elect. The elements of the subject, including the adjustment and use of the usual instruments. Textbook and lectures.
3 class hours. Credit, 3.
Professors Ostrander and Moore.

27. **III.** Plane Surveying. — For sophomores; juniors and seniors may elect. As stated under Course 26. Includes field work.
3 2-hour laboratory periods, credit, 3.
Laboratory fee, $1.50. Professors Ostrander and Moore.
Prerequisite, Mathematics 26.

28. **I.** Differential Calculus. — For sophomores and juniors; seniors may elect. The basic ideas and methods of the differential calculus. The course aims to give the student a realization of the power of the calculus as an instrument for dealing with problems of gometry and the physical sciences.
3 class hours. Credit, 3.
Assistant Professor Moore.
Prerequisite, Mathematics 1, 2, and 3.

29. **II.** Differential and Integral Calculus. — For sophomores and juniors; seniors may elect. A continuation of Mathematics 28 into the field of the integral calculus.
3 class hours. Credit, 3.
Assistant Professor Moore.
Prerequisite, Mathematics 28.

30. **III.** Integral Calculus. — For sophomores and juniors; seniors may elect. A continuation of Mathematics 29 with special emphasis upon the rate problems in physics and chemistry.
3 class hours. Credit, 3.
Assistant Professor Moore.
Prerequisite, Mathematics 29.

50. **I.** Analytical Geometry. — For juniors; seniors may elect. A discussion of the geometry of the line, the circle, conic sections, and the higher plane curves.
3 class hours. Credit, 3.
Professor Machmer.
Prerequisites, Mathematics 1, 2, and 3.

51. **II.** 52. **III.** Differential and Integral Calculus. — For juniors; seniors may elect. A first course in the subject, with some of the more important applications to applied sciences.
5 class hours, Credit, 5.
Assistant Professor Moore.
Prerequisites, Mathematics 1, 2, and 3.

53. **II.** Elementary Structures. — For juniors; seniors may elect. An elementary course in roofs and bridges. Textbook and lectures.
3 class hours. 1 2-hour laboratory period, credit, 4.
Professor Ostrander.

75. **I.** Hydraulics and Sanitary Engineering. — For seniors; juniors may elect. Hydrostatics, theoretical hydraulics, orifices, weirs, pipes, conduits, water supply, hydraulic motors, sewers and sewage treatment. Textbook and lectures.
5 class hours. Credit, 5.
Professor Ostrander.

76. **I.** Materials of Construction. Foundations and Masonry Construction. — For seniors; juniors may elect. Textbook and lectures.
5 class hours. Credit, 5.
Professor Ostrander.

77. **II.** Roads and Railroads. — For seniors; juniors may elect. Topographic and higher surveying, highway construction, earthwork, pavements, and railroad construction. Textbook and lectures.
3 class hours. Credit, 3.
Professor Ostrander.

78. **III.** Roads and Railroads. — For seniors; juniors may elect. As stated under Course 77.
3 2-hour laboratory periods, credit, 3.
Laboratory fee, $1.50. Professor Ostrander.
Prerequisite, Mathematics 77.

91. **II.** 92. **III.** Differential and Empirical Equations. — For seniors. A course dealing with the methods of solution of the simpler forms of differential equations and their applications to analogous operations in the applied sciences, particularly to chemical reactions. Attention is also given to the various methods of determining empirical equations from observed data, and the interpretation of the various constants involved.
3 class hours. Credit, 3.
Prerequisite, Mathematics 30. Assistant Professor Moore.

Physics.

Professor Powers, Assistant Professor Alderman.

The courses in this department present a basic study of the physical laws and phenomena of nature with special emphasis on the applications of the principles studied. These courses furnish satisfactory training for pre-medical students and for prospective teachers in secondary schools. Courses 25, 26, and 27 constitute a study in general physics. The other courses afford oportunity for more advanced and individual work.

Elective Courses.

25. **I.** Mechanics. — For sophomores; juniors and seniors may elect. This course is largely a study of the following and related topics: equilibrium of bodies; forms of energy and work; types of motion; fluids; surface tension; molecular phenomena; elasticity; wave-motion.
2 class hours. 1 2-hour laboratory period, credit, 3.
Laboratory fee, $2.00. The Department.

26. **II.** Magnetism and Electricity. — For sophomores; juniors and seniors may elect. Includes magnetism, electrostatics, production and properties of electric currents, electrical appliances and machines, oscillatory circuits, vacuum tubes, and related topics.
2 class hours. 1 2-hour laboratory period, credit, 3.
Laboratory fee, $2.00. The Department.

27. **III.** Heat and Light. — For sophomores; juniors and seniors may elect. Thermometry, expansion, hygrometry, transmission of heat, changes of state, radiation; wave theory of light, optical instruments, analysis of light, interference, polarization; allied subjects.
2 class hours. 1 2-hour laboratory period, credit, 3.
Laboratory fee, $2.00. The Department.

50. **I.** 51. **II.** 52. **III.** Magnetism, Electricity, Photo-electricity, Thermionics, and Applications. — For juniors and seniors. Course 50 deals largely with direct currents, Course 51 with alternating currents, and Course 52 with applications of thermionics and photo-electricity. These courses are planned to give the student a good grounding in theory and methods of measurement in the subjects indicated, which are useful in many fields of investigation. Modern methods are stressed and instruments of precision are used.
2 class hours. 1 2-hour laboratory period, credit, 3.
Laboratory fee, $2.00 per term. Professor Powers.
Prerequisites, Physics 26 for Courses 50 and 51; Physics 51 for Course 52.

54. **II.** Thermodynamics. — For juniors; seniors may elect. A study of energy changes due to heat in systems of matter. The subject material and experimental methods are useful in other branches of science.
2 class hours. 1 2-hour laboratory period, credit, 3.
Laboratory fee, $2.00. Assistant Professor Alderman.
Prerequisite, Physics 27.

55. **III.** Optics. — For juniors; seniors may elect. An intermediate course in the theory of light. Work in geometrical and physical optics is done. Precision instruments are used in the laboratory.
2 class hours. 1 2-hour laboratory period, credit, 3.
Laboratory fee, $2.00. Assistant Professor Alderman.
Prerequisite, Physics 27.

75. **I.** 76. **II.** 77. **III.** Advanced Experimental Work in Selected Topics. — For seniors and graduate students. These courses are largely experimental, and the subject matter is adapted to the needs of the individual student. The research viewpoint is emphasized.
3 2-hour laboratory periods, credit, 3.
Laboratory fee, $2.00 per term. Professor Powers.
Prerequisites, Physics 25, 26, 27, 50, 51, and 52; Mathematics 51 and 52.

85. I. 86. II. 87. III. Modern Physics. — For seniors. Typical subjects to be considered are theories of the atom, radiation, quantum theory, spectra, X-ray analysis, etc.

Credit, 3.
Professor Powers.

Prerequisites, Physics 25, 26, 27, 50, 51, 52, or equivalent; Mathematics 51 and 52.

Veterinary Science.

Professor Lentz.

The courses in veterinary science have been arranged to meet the needs (1) of students who propose following practical agriculture; (2) of prospective students of human and veterinary medicine; and (3) of teachers and workers in the biological sciences.

Elective Courses.

50. II. Veterinary Hygiene. — For juniors; seniors may elect. Acquaints students with the influences which air, water, feed, light, disposal of animal waste material, etc., may have upon the health of animals and upon the health of those who use both animals and animal products.
3 class hours. Credit, 3.
Professor Lentz.

75. I. Comparative Veterinary Anatomy. — For seniors; juniors may elect. The structure of the horse is studied and the structure of the other farm animals compared with it. This is a lecture and demonstrational course — not dissection — and is essential for students who wish to elect Veterinary 77.
3 class hours. Credit, 3.
Professor Lentz.

76. II. General Veterinary Pathology. — For seniors; juniors may elect. A study of fundamental, general pathological conditions; inflammation, fever, hypertrophy, atrophy, etc., a knowledge of which is essential in the prevention, diagnosis, and treatment of disease. Materia medica, therapeutic measures, and poisonous plants are considered briefly.
3 class hours. Credit, 3.
Professor Lentz.

77. III. Applied General Veterinary Pathology. — For seniors; juniors may elect. A continuation of Course 76, with specific application of principles to etiology, pathogenesis, and prophylaxis of communicable and non-communicable diseases of domesticated animals.
3 class hours. Credit, 3.
Professor Lentz.

89. II. Avian Pathology. — For seniors; juniors may elect. This is a lecture course devoted to principles of pathology, with specific application to avian diseases. Etiology, pathogenesis, and prophylaxis will be emphasized. Offered for the year 1930–31.
3 class hours. Credit, 3.
Professor Lentz.

Prerequisites, Bacteriology 50 and 51; Physiology 63, 64, and 65.

DIVISION OF SOCIAL SCIENCES.

Professor Mackimmie.

Agricultural Economics.

Professor Cance, Professor Lindsey, Assistant Professor Jefferson, Mr. Smart, Miss Foley.

Instruction in agricultural economics is designed to show that the agricultural industry justifies its existence chiefly as a supplier of food and raw textile materials for human consumption; that agricultural success is measured by produc-

tion of values as well as by production of volume of agricultural products; that the goal of the farmer is the largest net profit over a long-time period; that agricultural production includes all processes from purchase of seed and fertilizer and preparation of seedbed until the product reaches the consumer, including collection, transportation, storage, financing, packing, handling, and selling; that a knowledge of the business of agriculture and agricultural commerce is today more necessary than a knowledge of agricultural technique. The work of this department is conducted by means of lectures, readings, and research in both library and field.

Required Course.

26. **II.** Agriculture and Industry. — For sophomores. A course in applied economics. This course should acquaint the student with the variety and magnitude of the agricultural, manufacturing, and other allied industries, their geographic location, economic characteristics, the physical and social reasons for their location and character, their functions, their inter-relations, and their importance in our modern economic life.
3 class hours. Credit, 3.
Professor Cance and Miss Foley.

Elective Courses.

50. **I.** Elements of Agricultural Economics. — For juniors; seniors may elect. This course is designed to follow the course in elements of economics. It deals with the economic principles underlying the welfare and prosperity of the farmer and with those institutions upon which his economic success depends; the economic elements in the production and distribution of agricultural wealth; means of exchange; problems of land tenure and land values; taxation of farm property; and the maintenance of the economic status of the farmer. Lectures, text, readings, topics, and field work.
5 class hours. Credit, 5.
Professor Cance.

51. **III.** The Evolution of Agriculture. — For juniors; seniors may elect. A general survey of the evolution of the agricultural industry. Significant developments are traced and their causes and consequences studied. An attempt is made to give the student a knowledge of the changes which have taken place and which are taking place in the agricultural industry, the conditions which accompany these changes, and to furnish a basis by which the significance and the course of present and future developments in agriculture may be judged. Special emphasis will be placed on the development of agriculture in New England and the United States. Lectures, readings, and library work.
5 class hours. Credit, 5.
Miss Foley.

52. **II.** Co-operation in Agriculture. — For juniors; seniors may elect. The history, principles, and business relations of agricultural co-operation. (1) A survey of the development, methods, and economic results of farmers' organizations and great co-operative movements; (2) the business organization of agriculture abroad, and the present aspects and tendencies in the United States; (3) the principles underlying successful co-operative endeavor among farmers, and practical working plans for co-operative associations, with particular reference to purchase of supplies and the marketing of perishable products. Lectures, text, assigned readings, and practical exercises.
5 class hours. Credit, 5.
Professor Cance.

53. **III.** The Agricultural Market. — For juniors; seniors and graduate students may elect. A study of the forces and conditions which determine the prices of farm products and the mechanism, methods, and problems concerned with transporting, storing, and distributing them. Supply and demand, course of prices, terminal facilities, the middleman system, speculation in agricultural products, protective legislation, the retail market, and direct sales are taken up. The characteristics and possibilities of the New England market are given special

attention. Lectures, readings, assigned studies, and field work. Class trip to Boston or Springfield for market inspection, at an estimated expense of five to ten dollars.
5 class hours. Credit, 5.
Professor CANCE.

54. I. ECONOMICS OF CONSUMPTION. — For juniors; seniors and graduate students may elect. The purpose of this course is a consideration of the importance of consumption in modern industry and commerce. It includes a study of the laws of consumption, standards of living, sources and factors determining family incomes, and of the administration of these incomes as shown by the expenditures of the nation and of various groups. The relation of consumption to the problems of population and to the development of society is also studied. Lectures, assigned readings, and class discussions.
3 class hours. Credit, 3.
Assistant Professor JEFFERSON.

75. II. RURAL AND BUSINESS LAW. — For seniors; juniors may elect. Land, titles, public roads, rights incident to ownership of live stock, contracts, commercial paper, and distinctions between personal and real property. Text, written exercises, lectures, and class discussions.
5 class hours. Credit, 5.
Mr. SMART.

76. I. PRINCIPLES OF TRANSPORTATION. — For seniors and graduate students; juniors may elect. The development of highway, waterway, and railway transportation, and its relation to the agricultural and industrial development of the country; the principles governing the operation and control of transportation agencies; present-day problems relating to the shipment of farm products, rates, facilities, and services; methods of reducing wastes in transportation; the economics of the good roads movement and of motor transportation. Lectures, text, and field work.
5 class hours. Credit, 5.
Professor CANCE.

77. I. PROBLEMS IN AGRICULTURAL ECONOMICS. — For seniors and graduate students; juniors may elect. An advanced course for those desirous of studying more intensively some current economic problems. Studies in economic philosophy and the economic aspects and consequences of progress in the physical and biological sciences, current economic questions, agricultural legislation, and government aids and subsidies are some of the problems discussed. Particular attention will be given to economic problems relating to New England. Students will be encouraged to pursue lines of individual interest.
5 class hours. Credit, 5.
Professor CANCE.

78. III. AGRICULTURAL CREDIT AND FINANCE. — For seniors; juniors may elect. The use of credit in the production and marketing of agricultural products; the development, organization, and methods of operation of credit institutions. Methods of improving individual credit and increasing present credit facilities.
3 class hours. Credit, 3.
Professor LINDSEY.

79. I. PRINCIPLES AND METHODS OF STATISTICS. — For seniors and graduate students; juniors may elect. Methods of collecting, analyzing, interpreting, and presenting statistical information. The application of statistical methods to the fields of agriculture, economics, education, business, and industry is emphasized through practical laboratory problems.
2 class hours. 3 2-hour laboratory periods, credit, 5.
Professor LINDSEY.

80. I. 81. II. 82. III. SEMINAR. — For seniors and graduate students. Research in agricultural economics and history; problems of New England agri-

culture. Library work and reports. If desirable some other topic may be substituted.

1 or 2 2-hour conference periods, credit, 1 or 2.
The Department.

83. **I.** Economics of Salesmanship. — For seniors; juniors may elect. The course embraces a study of the principles and practices that are involved in the selling of goods and services. The application of these principles of salesmanship to the disposal of agricultural products is especially emphasized. Types of sales, motives for buying, securing interviews, types of prospects, preparation of sales talks, meeting objections and excuses, and sales demonstrations by students and the instructor are included.

2 class hours. Credit, 2.
Miss Foley.

84. **III.** Advertising Agricultural Products. — For seniors; juniors may elect. A course dealing with the application of the principles of advertising to agricultural products. A study of the nature of advertising, the economics of advertising, the use of media, copy, psychology as applied to advertising layout, the advertising campaign, advertising agency, etc., is made. The solution of practical problems to emphasize different phases of advertising is required of students.

2 class hours. Credit, 2.
Miss Foley.

85. **II.** Advanced Statistics. — For seniors and graduate students. The use of statistics in the analysis of economic data, with special emphasis on prices; the use of multiple correlation methods in price analysis.

3 2-hour laboratory periods, credit, 3.
Professor Lindsey.

Prerequisite, Agricultural Economics 79.

86. **III.** Agricultural Prices. — For seniors and graduate students. A study of prices of agricultural products and of other commodities of importance to agriculture.

2 or 3 2-hour laboratory periods, credit, 2 or 3.
Professor Lindsey.

Prerequisite, Agricultural Economics 79.

87. **III.** Foreign Trade in Agricultural Products. — For seniors and graduates; juniors may elect. A general course embracing a study of the principles and practices of international trade and the foreign commerce of the United States, particularly with reference to agricultural products. The development and present status of foreign trade in agricultural products, trade relations with foreign nations, the agencies and practices of foreign trade, foreign-trade salesmanship and advertising, the status of New England with reference to foreign trade are some of the topics which will be presented. The work in the course will also include a personal study of special features of foreign trade and of the trade importance of specific subjects. Textbook, class discussion, and class topics. Class trip to Boston at an estimated expense of twelve to fifteen dollars.

3 class hours. Credit, 3.
The Department.

88. **III.** Business Accounting. — For seniors; juniors may elect. This course aims to give the student an elementary working knowledge of the principles underlying the accounting system in the gathering, analysis, and interpretation of accounting data, and of the methods used in accounting and preparing the usual types of business statements. The managerial uses of accounting as a means of business control are the keynote of the course.

2 class hours. 3 2-hour laboratory periods, credit, 5.
Admission by permission of the instructor only.

Professor Lindsey.

Agricultural Education.

Professor Welles, Professor Glick, Mr. Heald.[1]

The primary aim of the department is to train students in some form of educational work. The department seeks to be of the greatest possible service to students who are preparing to teach and whose scholastic standing and general qualifications seem to make them suitable candidates for positions. Students desiring state approval as teachers of agriculture or related subjects should confer with the head of the department as early as possible, to insure a desirable range of preparation, including farm experience, a part of which may be gained after entering college. They should also become acquainted with the State Agent for Agricultural Teacher-Training, who approves candidates for positions in special schools and departments of agriculture in high schools. A Teacher-Training certificate will be awarded by the Division of Vocational Education to students who qualify as to farm experience, technical subjects, and educational courses as advised. The department recommends to the State Department of Education such graduates of the college as are qualified to receive the high school teachers' term certificate.

Students who major in other departments but expect to teach should consult this department regarding the educational courses best suited to their purposes.

Elective Courses.

29. **III.** Problems in American Education. — For sophomores; juniors and seniors may elect. The aim of this course is to introduce the student to the field of education through the study of the educational problems in the history of America from the beginning of the Colonial period to the present time. Such an understanding is to be desired in order that the citizens of tomorrow may be able to solve their own educational problems to better advantage.
3 class hours. Credit, 3.
Professor Welles.

51. **I** and **II.** Principles and Methods of Teaching. — For juniors; seniors may elect. The course is intended for those students who expect to become teachers. Others must have the consent of the head of the department before registering. The course is based on a good text in the general principles of teaching. School management is taught through "case studies" which may serve also to illustrate methods. Current educational literature relating to methods, certain books and assigned topics are required for reading and reports. A few teaching exercises are required in the class for illustration. By preference Course 55 should precede this.
3 class hours. Credit, 3.
Professor Welles.

52. **I.** History and Philosophy of Education. — For seniors and graduate students; juniors may elect. A general course in the history of educational theory and practice. Special emphasis is placed upon the philosophical background of education.
5 class hours. Credit, 5.
Professor Glick.

55. **I** and **II.** General Psychology. — For juniors; seniors and graduate students may elect. This is an introductory course for those anticipating further study in psychology, as well as a practical and cultural course for those who can take only one course in this field. It deals with the fundamental principles of psychology and their application to the understanding and control of human thought and action.
3 class hours. Credit, 3.
Professor Glick.

[1] State Agent for Agricultural Teacher-Training representing the State Department of Education in the administration of vocational education acts.

56. **II** and **III.** Educational Psychology. — For juniors; seniors and graduate students may elect. A direct application of psychology to the field of education, and a basic course for both general and specific methods. The course deals with the original nature of the child, the psychology of learning, individual differences, transfer of training, mental tests, etc. Intended primarily for prospective teachers, but open to others who are sufficiently interested.
3 class hours. Credit, 3.
Professor Glick.
Prerequisite, Agricultural Education 55 or consent of the instructor.

65. **III.** Experimental Psychology. — For juniors; seniors may elect. This course is for students majoring in Education or those major students from other departments who definitely expect to teach. The course covers lectures, assigned reading and laboratory experimentation.
2 class hours. 1 2-hour laboratory period, credit, 3.
Laboratory fee, $1.50. Professor Glick.
Prerequisite, Agricultural Education 55 or equivalent.

75. **III.** Principles of Secondary Education. — For seniors; juniors may elect. This is a study of the American high school. It is designed to acquaint the student with the aims of high school education, the characteristics and tendencies of high school students, the high school curriculum, extra-curricular activities, and the best ideas in regard to the administration of high schools.
3 class hours. Credit, 3.
Professor Welles.

76. **I** and **II.** Vocational Agricultural Teaching. — For juniors; seniors and graduate students may elect with permission of the head of the department. The course demands certain prerequisites of experience and objective which make permission necessary. It is the first of the series (76, 78, 82) and gives an introduction to the work of teaching agriculture in secondary schools, with essential information and observation preparatory to apprenticeship before the second term of the senior year.
3 class hours. Credit, 3.
Professor Welles and Vocational Division of State Department of Education.

77. **III.** Methods in Extension Teaching (1930–31). — For seniors; juniors and others qualified may elect. Candidates must consult the head of the department before registering. The course deals with various phases of extension work and the methods by which this work is accomplished. The specific lines are those of the county agent, boys' and girls' club leader, county demonstration agent, and agricultural specialist. The different phases of the work will be discussed by members of the Extension staff who are specialists in their particular lines. The course will be offered jointly by the Extension Service and the Department of Agricultural Education. Given in alternate years.
3 class hours. Credit, 3.
Professor Welles and Extension Service Staff.

78. **I, II,** and **III.** Apprentice Teaching. — For juniors or seniors by arrangement with the head of the department. Under certain conditions a student may be absent from college one term of his junior or senior year for apprentice teaching, depending upon the availability of an apprentice opening, and satisfaction of the other conditions. This is part of the required preparation leading to the Special Certificate for Teachers of Agriculture and is a substitute for Course 80 in these cases. It should be completed before the winter term of the senior year.
Credit, 5.
Professor Welles and Vocational Division of State Department of Education.

79. **III.** Tests and Measurements. — Limited to fifteen seniors majoring in the department. A study of the development, theory, and construction of the various types of tests and measurements, with special emphasis upon their use in the schools. Practice is given in the administration and scoring of tests. Modern statistical methods are applied to the interpretation of the results.
2 class hours. 1 2-hour conference period, credit, 3.
Professor Glick.

80. **I, II,** and **III.** Supervised Teaching. — For seniors; others qualified may be permitted to elect. No student will be enrolled for the course except by arrangement with the head of the department. Some opportunities for limited practice are available. A limited amount of study of teaching by observing is permitted. Special professional reading, assigned and optional, is required. A conference is required each week for reporting on the work each is doing and for general discussion. The amount of credit depends upon the amount and character of the work. A thesis covering all work in the course during the term is required.
1 class hour. 2 to 10 laboratory hours, credit, 1–5.
Professor Welles.
Prerequisite, Agricultural Education 51 and 55 or equivalents.

81. **III.** Seminar in Methods of Teaching. — For seniors and graduate students by arrangement with the instructor. This is an opportunity to become acquainted with the outstanding methods in use in public schools and pursue further special method studies other than agriculture as provided in Course 76.
2 class hours. Credit, 2.
Professor Welles.
Prerequisites, Agricultural Education 51 and 56 or equivalents.

82. **II.** The Technique of Teaching Agriculture. — For seniors and graduate students by arrangement with the head of the department; juniors in exceptional instances. This course follows Courses 76 and 78. While these are not absolute prerequisites, it will be an exceptional case in which any other order is permitted. This course covers the material, methods, policies, and special requirements of the state for agricultural teaching.
3 class hours. Credit, 3.
Professor Welles and Vocational Division of State Department of Education.

83. **III.** Seminar in Applied Psychology. — For seniors and graduate students. Intended for those who desire to study the application of psychology in special fields, such as salesmanship, advertising, medicine, law, public office, extension work, education, business, etc.
2 class hours. Credit, 2.
Professor Glick.
Prerequisites, Agricultural Education 55, and 56 or 85.

85. **I.** Vocational Psychology. — For seniors and graduate students. An application of psychology to the various fields of thought and action other than education.
3 class hours. Credit, 3.
Professor Glick.
Prerequisite, Agricultural Education 55 or consent of the instructor.

95. **II.** Modern Philosophy of Education. — For seniors and graduate students; juniors may elect. A general survey of modern philosophical theories and tendencies, with special emphasis upon their influence in determining present educational objectives and procedures. An analysis of the theories underlying various national cultures and ideals, and the significance of education in realizing definite educational objectives.
3 class hours. Credit, 3.
Professor Glick.

Economics, History, and Sociology.

Professor Mackimmie, Assistant Professor Cutler, Assistant Professor Jefferson, Mr. Williams.

The courses in economics and history are planned with the purpose of giving the student that knowledge and understanding of the important factors and problems in this field of study and life which every active citizen and educated man ought to have.

The courses in sociology, in addition, help equip a student for service as county agent, as agricultural or industrial or social economist, as family or boy's club or medical or psychiatric social worker, and as teacher of social science in high schools.

Economics.

Required Course.

25. **I.** Economic Principles. — For sophomores. Definitions of economic terms, such as wealth, capital, value, etc.; factors of production, exchange, and consumption; principles of economic production, supply and demand, diminishing returns, division of labor, productive organization; principles of exchange, theories of value, money and its problems; international trade, tariff and free trade theories; forms of income, wages, interest, rent, profits, and the forces which govern them; principles of spending, economy, luxury; principles and agencies for saving, investments, banks, building associations, insurance. Textbook and readings.
3 class hours. Credit, 3.
Professor Mackimmie.

Elective Courses.

51. **II.** Business and Industry. — For juniors and seniors. The forms, organization, administration, and labor problems of business. Methods of organizing, financing, and administering corporations and partnerships; forms of business administration, wholesaling, jobbing, retailing, advertising, credits and collections; system of industrial remuneration for wage earners, co-operation and preserving industrial peace; problems concerned with protective legislation for workmen and employers, sweated industries, prison labor, child labor, and industrial education.
5 class hours. Credit, 5.
Professor Mackimmie.

Prerequisite, Economics 25.

52. **III.** Public Finance, Taxation, Money and Banking. — For juniors and seniors. Systems and problems of taxation as they are found in Europe and America; objects for spending public revenue; public debts and methods of organizing them; systems of money and currency problems of America; types, methods, and functions of banks; economic and financial crises and depressions in the United States; modern war finance. Readings and lectures.
5 class hours. Credit, 5.
Professor Mackimmie.

Prerequisite, Economics 25.

History.

Required Course.

30. **III.** American History. — For sophomores. The rise and development of the United States, with special stress upon the origin of present conditions. Lectures and readings.
3 class hours. Credit, 3.
Assistant Professor Cutler.

Elective Courses.

25. **II.** American Government. — For sophomores; juniors and seniors may elect. A study of the structure and operation of the machinery of our

government; also a study of the history of its development from its inception to the present day.
3 class hours. Credit, 3.
Assistant Professor CUTLER.

28. **I.** ECONOMIC HISTORY OF THE UNITED STATES. — For sophomores; juniors and seniors may elect. A study of the factors and forces which have affected the economic development of the United States. Special attention is focused on the working out of economic principles, and on the inter-action between the economic, social, and political conditions and institutions. Text, lectures, and prepared discussions.
3 class hours. Credit, 3.
Assistant Professor JEFFERSON.

29. **II.** ENGLISH HISTORY. — For sophomores; juniors and seniors may elect. A study of the political, social, and religious movements in England, with special reference to an understanding of English literature.
3 class hours. Credit, 3.
Professor MACKIMMIE.

50. **I.** GOVERNMENT. — For juniors and seniors. Forms and working methods of the government of Great Britain, Germany, France, Russia, Switzerland, New Zealand, and Canada; historic types and theories of government; forms and methods of Federal, State, and local governments in America; progress and problems of democracy, and new reform movements in organization and administration; new tendencies towards social legislation and extension of governmental control.
3 class hours. Credit, 3.
Professor MACKIMMIE.

51. **II.** MODERN EUROPEAN HISTORY. — For juniors and seniors. The modern history of the principal countries of Europe, especially the great movements and revolutions that developed the nations up to the present generation.
3 class hours. Credit, 3.
Professor MACKIMMIE.

52. **III.** EUROPEAN HISTORY SINCE 1870. — For juniors and seniors. The Franco-Prussian War and the formation of the German Empire; the unification of Italy; the Third French Republic; European expansion in the East; the Russo-Japanese War; and the origin, events, and results of the War of 1914. While a continuation of Course 51, this course will be complete in itself and may be elected by those who have had no history training. Its aim is to provide the basis for an understanding of present-day conditions and for an intelligent participation in world affairs.
3 class hours. Credit, 3.
Professor MACKIMMIE.

SOCIOLOGY.

Elective Courses.

27. **I.** ELEMENTS OF SOCIOLOGY. — For sophomores; juniors and seniors may elect. A study of the individual considered as a member of his various groups; the group fallacy; the conditioned reflex; emotion; personality; social behavior; social stimulation; the group and the crowd; social attitudes, ideals, and adjustments; influence of environment; rural life; field and viewpoint of scientific sociology. Lectures and readings.
3 class hours. Credit, 3.
Assistant Professor CUTLER.

50. **I.** 51. **II.** 52. **III.** SOCIOLOGICAL LAWS AND THEIR APPLICATION. — For juniors; seniors may elect. A study of the scientific principles which characterize the relation of the individual to his various groups — the family, the school, the club, recreational institutions, the church, business, the govern-

ment, and others. Practical application. This study is especially directed toward rural phases of the subject. Lectures, readings, field work, discussions, and topical reports. These courses are sequential, but may be elected independently; together with Course 27, they constitute the basic series in sociology.
3 class hours. Credit, 3.
Assistant Professor Cutler.
Prerequisite, Sociology 27, or the consent of the instructor.

54. **II.** Historical Sociology. — For juniors; seniors may elect. Characteristics of primitive man, departure from the animal status and beginnings of civilization; origin and development of industries, arts, and sciences, including agriculture; the evolution of languages, warfare, migrations, and social institutions; a study of the powerful natural and human forces that have brought man from the early stages to modern development; characteristic features of the leading civilizations and races of ancient and modern times; beneficial and dangerous factors in American life.
5 class hours. Credit, 5.
Assistant Professor Cutler.
Prerequisite, Sociology 27.

55. **III.** The History of Religions. — For juniors; seniors may elect. This course will consist of a rapid survey of primitive religions, and of the religions of India, China, and Greece. Its aim will be to acquaint the student with the historical facts concerning these religions and also to give him an understanding of the spirit and the needs which prompted their rise. Consideration will be given to the application of the material of the course to current religious problems. The elements of similarity between these religions and the Christian religion will also be discussed.
3 class hours. Credit, 3.
Mr. Williams.

75. **I.** Problems of Social Reform. — For seniors; juniors by permission. Such current problems as eugenics, race suicide, divorce, crime and delinquent classes, prison reform, prevention and treatment of dependents and defectives, poverty, its causes and preventions; constructive modern social reform movements for insurance of wage earners, farm relief, protection of childhood, assurance of safety, health, and play time for all classes. The correctional and charitable institutions of Massachusetts are studied in considerable detail.
5 class hours. Credit, 5.
Assistant Professor Cutler.
Prerequisites, Sociology 50, 51, and 52, or the consent of the instructor.

76. **I.** Field Work in Sociology. — For seniors; juniors may elect. Designed to meet the needs of students who wish to do some constructive work in social service while still in college. The work is carried on in co-operation with the various college agencies engaged in rural service. Any project for which credit in this course is to be asked must first have the approval of the head of the department.
2 to 6 laboratory hours, credit, 1 to 3.
Assistant Professor Cutler.
Prerequisites, Sociology 27, or 50, 51, and 52.

77. **III.** Sociological Research. — For seniors; juniors may elect. Research methods — measurements, exploration, criticism, surveys; a careful study of the scientific method as applied to social problems; the technique of investigation and research; the procedure of gathering sociological data by means of the survey; the interpretation and graphic presentation of social facts. Text, lectures, field and laboratory work.
3 class hours. Credit, 3.
Prerequisites, Sociology 50, 51, and 52, or the consent of the instructor.
Assistant Professor Cutler.

79. **I.** 80. **II.** 81. **III.** SEMINAR. — Enrolment is open to graduate students, and seniors majoring in social science who are especially prepared. Topics recently studied are: sociology of American colonies in the Caribbean region; success in rural leadership; rural sociology of the Old World and Far East; the standard of living in American rural life; proposed improvements in rural local government; international agricultural problems; the art of straight thinking. Courses are sequential but may be elected independently.
2 class hours. Credit, 2.
Professors MACKIMMIE and CUTLER.

Languages and Literatures.

Professor PATTERSON, Professor JULIAN, Associate Professor PRINCE, Associate Professor RAND, Assistant Professor GODING, Mr. BARNARD, Mr. ELLERT, Mr. PHINNEY, Mrs. ROBERTSON.

The courses in English are intended to enable students to express themselves effectively and to appreciate the ideals of English-speaking people throughout their history.

The aim of the courses in French, Spanish, and German is to give the student a practical knowledge of these languages for the purpose of wider reading and research, to introduce him to some of their treasures in art and science, and through the literature to acquaint him with the people.

The courses in History and Interpretation of Music are non-technical in treatment and are intended for those who wish a background of the history of music and its interpretation.

ENGLISH.

Required Courses.

1. **I. II.** 3. **III.** ENGLISH. — For freshmen. Composition. Intended to teach straight thinking, sound structure, clear and correct expression. Lectures, recitations, theme writing, and conferences.
3 class hours. Credit, 3.
Professors PATTERSON, PRINCE, RAND, Mr. BARNARD, and Mr. PHINNEY.

25. **I.** 26. **II.** 27. **III.** ENGLISH. — For sophomores. A general reading course in English literature.
2 class hours. Credit, 2.
Professor PATTERSON.

28. **I.** 29. **II.** 30. **III.** ENGLISH. — For sophomores. Public speaking.
1 class hour. Credit, 1.
Associate Professors PRINCE and RAND, Mr. BARNARD, and Mr. PHINNEY.

Elective Courses.

50. **III.** ENGLISH POETRY AND THE ROMANTIC MOVEMENT (1931–32). — Alternates with Course 67. For juniors and seniors. A study chiefly in the beginning of Romanticism in English Poetry as found in the work of Collins, Gray, Burns, and Blake, with considerable attention to the culmination of Romanticism in the poetry of Shelley.
3 class hours. Credit, 3.
Associate Professor PRINCE.

51. **II.** ENGLISH POETRY OF THE NINETEENTH CENTURY (1930–31). — Alternates with Course 54. For juniors and seniors. Especial attention is given to Landor, Tennyson, Arnold, and Clough.
3 class hours. Credit, 3.
Professor PATTERSON.

52. **II.** ENGLISH WRITERS FROM MILTON TO POPE. — For juniors; seniors may elect. Some of the writers studied are Milton, Bunyan, Dryden, and Pope.
3 class hours. Credit, 3.
Professor PATTERSON.

53. **II.** English Prose of the Eighteenth Century. — For juniors; seniors may elect. A brief exposition of the thinking of the period, in philosophy, government, and criticism is followed by a study of essayists and letter writers from Defoe to Godwin.
3 class hours. Credit, 3.
Associate Professor Prince.

54. **II.** English Prose in the Early Nineteenth Century (1931–32). — Alternates with Course 51. For juniors and seniors. Coleridge, Lamb, DeQuincey, Hazlitt, Macaulay.
3 class hours. Credit, 3.
Professor Patterson.

55. **II.** American Prose. — For juniors; seniors may elect. A course in the chief American prose writers, among those studied being Franklin, Brockden Brown, Irving, Cooper, Poe, Melville, Hawthorne, Emerson, Thoreau, Parkman.
3 class hours. Credit, 3.
Associate Professor Prince.

56. **III.** American Poetry. — For juniors; seniors may elect. A course in the chief American poets, among those studied being Freneau, Bryant, Poe, Emerson, Longfellow, Whittier, Lowell, Whitman, Lanier.
3 class hours. Credit, 3.
Associate Professor Prince.

57. **III.** Browning and the Pre-Raphaelites. — For juniors; seniors may elect. The course will be devoted especially to Browning and Swinburne, with some attention to Dante Gabriel Rossetti and William Morris.
3 class hours. Credit, 3.
Professor Patterson.

58. **III.** English Prose of the Victorian Age. — For juniors; seniors may elect. The essayists will be considered, especially Carlyle, Ruskin, Newman, Arnold, Pater, and Stevenson.
3 class hours. Credit, 3.
Mr. Barnard.

60. **I.** Keats and Byron. — For juniors; seniors may elect.
3 class hours. Credit, 3.
Professor Patterson.

61. **II.** Chaucer. — For juniors; seniors may elect. Reading of the principal works of Chaucer; a study of Chaucer's development as a creative artist; an attempt to appreciate his humanism.
3 class hours. Credit, 3.
Associate Professor Prince.

63. **III.** Shakespeare (1931–32). — Alternates with Course 75. For juniors and seniors. Three or four representative plays will be studied as closely as possible.
3 class hours. Credit, 3.
Professor Patterson.

Prerequisite, English 79.

64. **I.** The Lake Poets (1930–31). — Alternates with Course 68. For juniors and seniors. A study of the background, the theories and the poetry of the Lake Poets, the leaders of whom were Wordsworth and Coleridge.
3 class hours. Credit, 3.
Associate Professor Rand.

65. **I.** Advanced Composition. — For juniors; seniors may elect. Advanced work in expository writing, based upon specimens by contemporary authors and upon the personal experience of the student. Particular attention is given to organization and style.
3 class hours. Credit, 3.
Associate Professor Rand.

66. **II.** Theses. — For juniors; seniors may elect. The preparation of theses and similar manuscripts upon subjects selected by the student. An orderly accumulation of material is followed by an intelligent and readable interpretation of its significance.
3 class hours. Credit, 3.
Associate Professor Rand.

67. **III.** Narrative Writing (1930–31). — Alternates with Course 50. For juniors and seniors. Journalistic and fictional narrative with supplementary reading. Especial attention is given to the writing of the short story.
3 class hours. Credit, 3.
Associate Professor Prince.

68. **I.** The Tudor Poets (1931–32). — Alternates with Course 64. For juniors and seniors. A study of the non-dramatic poetry of the Tudor period, culminating in the work of Edmund Spenser and the Elizabethan lyrists.
3 class hours. Credit, 3.
Associate Professor Rand.

71. **I.** Elizabethan Dramatists. — For juniors; seniors may elect. A study of the types of Elizabethan drama, exclusive of Shakespeare, with special consideration of the plays of such men as Lyly, Peele, Greene, Kyd, Marlowe, Jonson, Beaumont, Fletcher, Webster, Massinger.
3 class hours. Credit, 3.
Associate Professor Prince.

75. **II.** The Novel (1930–31). — Alternates with Course 63. For juniors and seniors. A rapid survey of the beginnings of the novel will be followed by a somewhat careful study of its types and development as revealed in such works as Tom Jones, Vicar of Wakefield, Pride and Prejudice, Ivanhoe, David Copperfield, Vanity Fair, Kidnapped, Tess of the D'Urbervilles, Esther Waters, Rise of Silas Lapham, House of Mirth.
3 class hours. Credit, 3.
Professor Patterson.

79. **II.** Shakespeare. — For seniors; juniors may elect. A cursory survey of the origin and rise of English drama is followed by the reading of about fifteen of Shakespeare's plays, selected to indicate the evolution of the dramatist and to emphasize the various phases of his art.
3 class hours. Credit, 3.
Associate Professor Rand.

80. **III.** Modern Drama (1930–31). — Alternates with Course 81. For juniors and seniors. This course will trace the development of English drama from Robertson to the present day. The purpose of the course is to impart an intelligent and sympathetic interest in the theatre of the twentieth century.
3 class hours. Credit, 3.
Associate Professor Rand.

81. **III.** Modern Poetry (1931–32). — Alternates with Course 80. For juniors and seniors. This course attempts to trace the spirit of Twentieth Century poetry from such authors as Hardy, Whitman, and Emily Dickinson to those of the present day.
3 class hours. Credit, 3.
Associate Professor Rand.

Public Speaking.

Elective Courses.

50. **I.** Argumentation. (1930–31). — Alternates with Course 52. For juniors and seniors. Presents the fundamental principles of argumentation as applied to oral and written discourse, and develops in the student power to handle argument convincingly and persuasively. Lectures, discussions of leading

questions of the day, practice in brief-drawing and the writing of forensics. The course is recommended for those who desire to enter the intercollegiate debates.
3 class hours. Credit, 3.
Associate Professor PRINCE.

51. **III.** OCCASIONAL ORATORY. — For juniors; seniors may elect. A study of the principles and the practice of formal oratory; the preparation and delivery of one original oration; prescribed reading in oratory. The course is recommended for those who wish to enter the Flint Contest.
3 class hours. Credit, 3.
Associate Professor PRINCE.

52. **I.** EXTEMPORE SPEAKING (1931–32). — Alternates with Course 50. For juniors and seniors. The course is intended to give the student practice in thinking upon his feet and in presenting cogently his thinking to a public group.
3 class hours. Credit, 3.
Associate Professor PRINCE.

FRENCH.

Elective Courses.

1. **I.** 2. **II.** 3. **III.** ELEMENTARY FRENCH. — For freshmen; sophomores, juniors, and seniors may elect. The essentials of grammar are rapidly taught and will be accompanied by as much reading as possible.
3 class hours. Credit, 3.
Assistant Professor GODING.

4. **I.** 5. **II.** 6. **III.** INTERMEDIATE FRENCH. — For freshmen; sophomores, juniors, and seniors may elect. Training for rapid reading. The reading of a number of short stories, novels, and plays; composition, reports on collateral reading from periodicals and scientific texts in the library.
3 class hours. Credit, 3.
Assistant Professor GODING and Mrs. ROBERTSON.
Prerequisites, French 1, 2, and 3, or Entrance French.

25. **I.** 26. **II.** 27. **III.** INTERMEDIATE FRENCH. — For sophomores; juniors and seniors may elect. Training for rapid reading. The reading of a number of short stories, novels, and plays; readings from periodicals and scientific texts in the library.
3 class hours. Credit, 3.
Mrs. ROBERTSON.
Prerequisites, French 1, 2, and 3.

28. **I.** 29. **II.** 30. **III.** ADVANCED FRENCH. — For sophomores; juniors and seniors may elect. A general survey of the history of French literature and the development of French culture, with representative works of the important periods. Lectures. Outside readings.
3 class hours. Credit, 3.
Assistant Professor GODING.
Prerequisites, French 4, 5, and 6, or 25, 26, and 27.

50. **I.** FRENCH LITERATURE. — For juniors; seniors may elect. A detailed study of the Romantic period. Readings from Hugo, de Vigny, Lamartine, de Musset, and others. Influence of English, German, and Italian literature is stressed. Lectures and outside readings.
3 class hours. Credit, 3.
Assistant Professor GODING.
Prerequisites, French 4, 5, and 6, or 25, 26, and 27.

51. **II.** French Literature. — For juniors; seniors may elect. A detailed study of the Realistic period. Readings from Balzac, Flaubert, Stendhal, and others. Lectures, outside readings.
3 class hours. Credit, 3.
Assistant Professor Goding.
Prerequisites, French 4, 5, and 6, or 25, 26, and 27.

52. **III.** French Literature. — For juniors; seniors may elect. Later nineteenth century and modern French literature. Readings from Rostand, Loti, Daudet, Anatole France, and others. Discussions of contemporary authors. Modern criticism.
3 class hours. Credit, 3.
Assistant Professor Goding.
Prerequisites, French 4, 5, and 6, or 25, 26, and 27.

75. **I.** 76. **II.** 77. **III.** French Literature. — For seniors; juniors may elect. Survey of the Classical period, with readings from representative works.
2 class hours. Credit, 2.
Mrs. Robertson.
Prerequisites, French 4, 5, and 6, or 25, 26, and 27.

81. **III.** Methods of Teaching French. — For seniors; juniors may elect with the consent of the instructor. This course is designed to meet the needs of students intending to teach French and those desiring a more accurate knowledge of the French language. The elements of pronunciation will be studied scientifically and from the standpoint of the teacher. There will be a rapid but thorough review of grammar which will be followed by a discussion on textbooks and reading materials.
2 class hours. Credit, 2.
Assistant Professor Goding.
Prerequisites, French 4, 5, and 6, or 25, 26, and 27, and, in addition, one year of advanced French.

Spanish.

Elective Courses.

50. **I.** 51. **II.** 52. **III.** Elementary Spanish. — For juniors; seniors may elect. Open to other students upon arrangement. Grammar, exercises in composition and conversation, reading of selected short stories.
3 class hours. Credit, 3.
Mrs. Robertson.

75. **I.** 76. **II.** 77. **III.** Modern Spanish Authors. — For seniors. Reading from modern Spanish novel and drama; composition; outside reading.
2 class hours. Credit, 2.
Mrs. Robertson.
Prerequisite, Spanish 52.

Music.

Elective Courses.

50. **I.** History and Interpretation of Music. — For juniors; seniors may elect. The Classical School. Works of Bach, Handel, Haydn, and Mozart are performed and studied. Lectures, musical illustrations, and outside readings.
3 scheduled hours. Credit, 2.
Laboratory fee, $1.50. Assistant Professor Goding.

51. **II.** History and Interpretation of Music. — For juniors; seniors may elect. A continuation of Course 50. The Romantic School — Beethoven, Schubert, Weber, Mendelssohn, Schumann, Chopin, Berlioz, Liszt.
3 scheduled hours. Credit, 2.
Laboratory fee, $1.50. Assistant Professor Goding.

52. **III.** History and Interpretation of Music. — For juniors; seniors may elect. The Italian, French, and German schools of opera; modern and contemporary composers.
3 scheduled hours. Credit, 2.
Laboratory fee, $1.50. Assistant Professor Goding.

75. **I.** 76. **II.** 77. **III.** Ensemble Music. — For juniors and seniors. This course will include lectures on history of development of the orchestra and orchestral music, choral music, and band, theory and practice in harmony, arrangement and transposition of various numbers for the use of orchestra, chorus, and band. It is designed to give fundamental instruction that should be of direct value to the student for enjoyment and performance of musical compositions. All students registering for the course are expected to belong to the orchestra, chorus, or band. Course 75 is prerequisite to Course 76, and Course 76 to Course 77.
3 scheduled hours.. Credit, 2.
Laboratory fee, $1.50 per term. Assistant Professors Goding and Cubbon.

German.

Elective Courses.

1. **I.** 2. **II.** 3. **III.** Elementary German. — For freshmen; sophomores, juniors, and seniors may elect. Grammar, reading, and prose composition. Special emphasis is placed on the acquirement of a fundamental stem vocabulary and the ability to understand simple German paragraphs in German.
3 class hours. Credit, 3.
Professor Julian and Mr. Ellert.

4. **I.** 5. **II.** 6. **III,** Intermediate German. — For freshmen; sophomores, juniors, and seniors may elect. Reading and study of some important literary productions in the field of the novel and the drama.
3 class hours. Credit, 3.
Mr. Ellert.

Prerequisites, German 1, 2, and 3, or Entrance German.

25. **I.** 26. **II.** 27. **III.** Intermediate German. — For sophomores; juniors and seniors may elect. The German short story; grammar review and advanced prose composition.
3 class hours. Credit, 3.
Mr. Ellert.

Prerequisites, German 1, 2, and 3.

28. **I.** 29. **II.** 30. **III.** Advanced German. — For sophomores; juniors and seniors may elect. Goethe's Faust.
3 class hours. Credit, 3.
Professor Julian.

Prerequisites, German 4, 5, and 6, or 25, 26, and 27.

50. **I.** 51. **II.** 52. **III.** Scientific German. — For juniors and seniors. Intensive and specialized reading of literature in standard German scientific journals and reference books.
3 class hours. Credit, 3.
Professor Julian.

Prerequisites, German 4, 5, and 6, or 25, 26, and 27.

75. **I.** 76. **II.** 77. **III.** German Literature. — For seniors. Advanced language and literary study, conducted entirely in German. Lectures on German literature and history; collateral readings, including masterpieces of different epochs, such as *Niebelungenlied,* and some typical modern drama.
3 class hours. Credit, 3.
Professor Julian.

Prerequisites, German 28, 29, and 30.

GENERAL DEPARTMENTS.

Military Science and Tactics.

Major Karl S. Bradford, Cav. (D. O. L.), U. S. A.; Major Gordon J. F. Heron, Cav. (D. O. L.), U. S. A.; Captain Edwin M. Sumner, Cav. (D. O. L.), U. S. A.; Technical Sergeant Johnathan Madden, U. S. A., Retired; Technical Sergeant James A. Warren, Cav. (D. E. M. L.), U. S. A.; and a detachment of enlisted men of the United States Army.

Under act of Congress, July 2, 1862, the College was required to provide a two-year course in military instruction under a regular army officer. All able-bodied four-year male students are required to take this course. Under act of Congress, June 3, 1916, as amended by act of Congress, September 8, 1916, there was established at this college in April, 1917, an infantry unit of the Reserve Officers' Training Corps. Following the World War and an act of Congress, July 19, 1918, the Reserve Officers' Training Corps has been in operation under the regulation of the War Department, administered by the president of the college and the professor of military science and tactics. Beginning with the fall term, 1920–21, the infantry unit of the Reserve Officers' Training Corps was converted into a cavalry unit.

The primary object of the Reserve Officers' Training Corps is to provide systematic military training at civil educational institutions, for the ultimate purpose of qualifying selected students of such institutions as reserve officers in the military forces of the United States. It is intended to attain this object during the time the students are pursuing their general or professional studies, with the least practicable interference with their civil careers, by employing methods designed to fit men physically, mentally, and morally for pursuits of peace as well as war.

The course for cavalry units of the Reserve Officers' Training Corps includes theoretical and practical instruction in all phases of cavalry work, so distributed over the four-year college course as to qualify students at the end of the freshman year as privates of cavalry, at the end of the sophomore year as non-commissioned officers of cavalry, and upon graduation as reserve officers. The instruction in this department covers cavalry drill, cavalry weapons — rifle, pistol, saber, automatic rifle, and machine gun — map reading and military sketching, minor tactics, equitation, etc. The course in equitation includes cross-country riding and instruction in polo. Fifty-three per cent of the course is classroom work. All practical instruction is out of doors.

All male candidates for a degree in the four-year course must take at least three hours a week of military training for two years. Students who are approved by the president and the professor of military science and tactics may take the advanced course in their junior and senior years if they so elect. The advanced course consists of at least five hours per week and a summer camp of about six weeks during the summer vacation between the junior and senior years. Students taking this course are paid by the Federal Government at a rate to be fixed by the Secretary of War, not to exceed the value of the army ration. The rate now fixed is thirty cents per day, which, with all allowances, amounts to about two hundred and thirty-five dollars. Students graduating in the advanced course are eligible for commissions in the Officers' Reserve Corps, but are not required to accept such commissions if offered.

The uniform furnished to the freshmen and sophomores (basic course) is of olive drab woolen cloth, and is supplied by the Federal Government without cost except for the necessary alterations. The uniforms for the juniors and seniors (advanced course) are of the forest green woolen cloth, tailor-made for the individual student. A deposit of thirty dollars for this uniform is required at the beginning of the junior year. The student is reimbursed through the allowances for clothing and rations.

Required Courses.

1. **I.** 2. **II.** 3. **III.** For freshmen. Theoretical and practical instruction in courtesy and discipline, riding, rifle marksmanship, hygiene and sanitation, drill, and history.

3 scheduled hours, credit, 2.
Army Instructors.

25. I. 26. II. 27. III. For sophomores. Theoretical and practical in struction in leadership, riding, drill, saber, automatic rifle and pistol, mounte sports, and polo.

3 scheduled hours. credit, 2
ARMY INSTRUCTORS.

Elective Courses.

50. I. 51. II. 52. III. For juniors. Cavalry drill and riding, selectio and care of horses, pistol marksmanship, machine guns, map reading, map mak ing, mounted sports, jumping, polo.

5 scheduled hours, credit, 3
ARMY INSTRUCTORS.

75. I. 76. II. 77. III. For seniors. Military law, history, correspon dence and records, engineering (bridges and explosives), cavalry drill, leadershi and command, riding, mounted sports, competitions, horse-show preparation an management, polo, cross-country riding.

5 scheduled hours, credit, 3
ARMY INSTRUCTORS.

Physical Education and Hygiene.

Professor HICKS, Professor GORE, Mrs. HICKS, Assistant Professor DERBY, Mr. BALL, Mr. BRIGGS, Mr. MCGEOCH.

The purpose of the laboratory courses offered by this department is to provid active exercise regularly, in order that all students may properly care for thei health and maintain their physical condition throughout their college course. I is also hoped that the health and exercise habits thus established will be con tinued after leaving college. The course in Hygiene for men is a series of lec tures designed to give to the new student the simple rules of living both as a individual and in his relations with others. The required courses for men and fo women are supplemented by special lectures on social hygiene and social rela tions. The elective courses for men are offered for those students who are pre paring to teach. The majority of our graduates who enter the teaching profes sion in either the public or private schools are expected to do some physical edu cation or athletic work either as coaches or administrators.

[All undergraduate male students are given a physical examination upon entering. All undergraduat women students are required to present as a part of their entrance record, a form report of a physical exam nation by their family physician.]

MEN.

Required Courses.

1. I. HYGIENE. — For freshmen. Lectures on personal hygiene, includin the physiological basis for sound health habits, the importance of the systemati planning of a student's daily program in order to provide the proper amount of time for study, with suitable periods of sleep, relaxation, recreation, and sports; posture, appropriate types of exercise, proper nutrition, social adjust ment, the necessity for frequent medical, optical, and dental advice; sanitation and group health requirements.
1 class hour. Credit, 1
Professor HICKS.

2. I. RECREATION. — For freshmen. Outdoor games are taken up progres sively and include soccer, touch football, kick football, and cricket. Men may elect freshman football, cross-country, track, or baseball. The course gives every man the opportunity to develop sufficient control over his body to en able him to get pleasure from physical activities and thus develop habits of exercise which will continue in later life.

2 laboratory hours, credit, 1.
Assistant Professor DERBY and Messrs. BALL, BRIGGS, and MCGEOCH.

3. **III.** Recreation. — For freshmen. Outdoor games in the regular class ork include long base, playground ball, speed ball, track and field events, and olley ball. Men may elect tennis, golf, polo, freshman baseball or track, or arsity football. The course aims to encourage health habits and to give a fund f exercise material for use in after-school days.

2 laboratory hours, credit, 1.

Assistant Professor Derby and Messrs. Ball, Briggs, and McGeoch.

25. **I.** Recreation. — For sophomores. Continuation of Course 2, with ıore difficult skills and co-ordinations. Emphasis is placed on healthful, big-ıuscle activities, and the guidance of play spirit. Soccer, touch football, kick ɔotball, and cricket are played. Men may elect tennis, golf, polo, varsity foot-all, baseball, track, or cross-country.

2 laboratory hours, credit, 1.

Assistant Professor Derby and Messrs. Ball, Briggs, and McGeoch.

26. **III.** Recreation. — For sophomores. Continuation of Course 3, with ›rogression. Increased attention is given to the games that provide situations hat will give instruction in citizenship through leadership and response to com-ıands. Opportunity is given for self-expression through games. Playground ›all, speedball, track and field events, and volley ball are played. Men may lect tennis, golf, polo, varsity football, baseball, or track.

2 laboratory hours, credit, 1.

Assistant Professor Derby and Messrs. Ball, Briggs, and McGeoch.

Elective Courses.

71. **I.** Physical Education Theory. Outline Course for Teacher-Coaches. — For juniors and seniors. Admission by permission only. This ourse outlines the coaching of football and soccer; competitive psychology; and ıealth education programs for secondary schools. Lectures, collateral readings, heory situations and notebook.

2 class hours. Credit, 2.

Professor Gore and Mr. Briggs.

72. **I.** Physical Education Practice. Normal Course for Teacher-Coaches. — For juniors and seniors. Admission by permission only. Directed eaching, practice teaching, observation, officiating, and supervision of foot-›all, soccer, and health education programs.

2 2-hour laboratory periods, by arrangement, credit, 1.

Professor Gore and The Department.

81. **II.** Physical Education Theory. Outline Course for Teacher-Coaches. — For juniors and seniors. Admission by permission only. Continua-ion of Course 71. This course includes the outline of coaching basketball, ıockey, boxing, wrestling, athletic pedagogy; and school programs in physical ducation. Lectures, collateral readings, theory situations and notebook.

2 class hours. Credit, 2.

Professor Gore, Assistant Professor Derby, Mr. Ball, and Mr. McGeoch.

82. **II.** Physical Education Practice. Normal Course for Teacher-Coaches. — For juniors and seniors. Admission by permission only. Directed teaching, practice teaching, observation, officiating, and supervision of basketball, hockey, boxing, wrestling, and school programs in physical education.

2 2-hour laboratory periods, by arrangement, credit, 1.

Professor Gore and The Department.

91. **III.** Physical Education Theory. Outline Course for Teacher-Coaches. — For juniors and seniors. Admission by permission only. Continua-tion of Courses 71 and 81. This course outlines the coaching of baseball, track and field athletics; the teaching of miscellaneous games; the conduct of intra-mural athletics; scouting and camping.

2 class hours. Credit, 2.

Professor Gore, Assistant Professor Derby, Mr. Ball, and Mr. Briggs.

92. **III.** Physical Education Practice. Normal Course for Teacher-Coaches. — For juniors and seniors. Admission by permission only. Directed teaching, practice teaching, observation, officiating, and supervision of baseball track and field athletics, miscellaneous games, intramural athletics, scouting and camp craft.

2 2-hour laboratory periods, by arrangement, credit, 1.
Professor Gore and The Department.

84. **II.** Physical Education Theory. History and Purposes of Physical Education. — For seniors. Admission by permission only. A brief study of the history of the development of the various systems of physical education and the men who promote them, a study of the aims and ideals of present day physical educators, a study of some of the problems of athletic supervision and physical education administration. This course is intended for those who expect to deal with administrative problems of school programs of physical education and athletics. Lectures, recitations, textbooks, reports on assigned readings, and a final outline of a school program.

2 class hours. Credit, 2.
Professor Hicks.

95. **III.** Physical Education Theory and Practice. First Aid, Training and Safety Education. — For seniors. This course consists of first aid as applied in the home, on the street and on the athletic field. Prevention of athletic injuries, conditioning, and safety education are considered. Practice is given in bandaging and taping. Men who complete this course satisfactorily will be given American Red Cross First Aid Certificates. Lectures, demonstrations and notebook.

1 class hour. 1 2-hour laboratory period, by arrangement, credit, 1.
Professor Gore.

Women.

Required Courses.

4. **I.** Recreation. — For freshmen. Outdoor games.
3 scheduled hours, credit, 2.
Mrs. Hicks.

5. **II.** Gymnastics. — For freshmen. Body mechanics, folk and national dancing, gymnastics.
3 scheduled hours, credit, 2.
Mrs. Hicks.

6. **III.** Recreation. — For freshmen. Outdoor games.
2 scheduled hours, credit, 1.
Mrs. Hicks.

27. **I.** Recreation. — For sophomores. Outdoor games.
5 scheduled hours, credit, 3.
Mrs. Hicks.

28. **II.** Gymnastics. — For sophomores. Body mechanics, folk and national dancing, gymnastics, rhythms, games.
3 scheduled hours, credit, 2.
Mrs. Hicks.

29. **III.** Recreation. — For sophomores. Outdoor games.
5 scheduled hours, credit, 3.
Mrs. Hicks.

Elective Courses.

50. **II.** Rhythms. — For juniors. Rhythmic dancing, clog dancing.
3 scheduled hours, credit, 2.
Mrs. Hicks.

76. **II.** Rhythms. — For seniors. Rhythmic dancing, clog dancing.
3 scheduled hours, credit, 2.
Mrs. Hicks.

The Graduate School.

Roscoe W. Thatcher, D.Agr., LL.D., President of the College.

Fred J. Sievers, M.S., Director of the Graduate School: Director of Experiment Station.

Graduate Staff, 1930–1931.

President Thatcher, Director Sievers, Dean Machmer, Heads of Divisions, Heads of Departments offering graduate courses, Professors, Associate Professors, and Assistant Professors teaching graduate subjects; R. D. Hawley, Secretary.

General Statements.

Graduate courses leading to the degrees master of science, master of landscape architecture, master of agriculture, doctor of agriculture, and doctor of philosophy have been available at the college for more than twenty years, and the graduate school work has been in great demand. Graduate students desiring advanced courses, but who do not wish to take advanced degrees, are also admitted.

Admission.

Admission to the graduate school will be granted: —

1. To graduates of the Massachusetts Agricultural College.
2. To graduates of other institutions of good standing, who have received a bachelor's degree substantially equivalent to that conferred by this college.

In case an applicant presents his diploma from an institution of accepted standing, but has not taken as much of the subject he desires to select for his major study as is required of undergraduates at the Massachusetts Agricultural College, he will be required to make up such parts of the undergraduate work in that department as the head of the department may consider necessary, without credit toward his advanced degree. In the case of minor subjects for advanced degrees, credit begins to accrue from the point where the previous training of the applicant ended, whether it be graduate or undergraduate in its rating at this college, subject however to such limitations as may be fixed by the department concerned. (See department statements.)

Applications for membership in the graduate school should be presented to the director of the school. An official transcript of the applicant's collegiate record, and a statement of the graduate work desired and whether the applicant intends to study for a degree should be submitted.

Registration as a graduate student should be promptly made at the director's office and must be renewed for each term thereafter.

The Graduate Work.

Candidates for the degree of doctor of philosophy are required to prosecute three subjects, one of which shall be designated as the major and the others as minors. No two of these subjects may be taken in the same department. An original thesis shall be considered a part of the major subject.

Candidates for the degree of doctor of agriculture are required to select a major and such other subjects as will develop the major in its greatest intensity and comprehensiveness. Successful experience is also requisite, together with a thesis which represents a masterly survey or intimate study through accurate application of some phase of the major subject.

Candidates for the degree of master of science are required to prosecute two subjects, one of which shall be designated as a major and the other as a minor. When desirable, and approved by the director, the minor may be made up of subjects from more than one department. The major and minor subjects may not be selected in the same department. An original thesis is considered a part of the major subject.

Candidates for the degree of master of agriculture are allowed greater privileges in the selection of subjects, but will be required to select a major and such other supporting lines of study as will be necessary to equip the individual professionally. A thesis which will reveal the professional training of the individual will be required.

Candidates for the degree of master of landscape architecture will be expected to conform to the established courses of the department, and to the requirements of the department in the preparation of a thesis, as well as in actual experience outside the college.

Candidates for membership in the graduate school who do not desire to work for a degree may, with the approval of the director of the school, take more than one subject in the same department, or pursue work in several departments, if their preparation will permit. A statement of the subjects chosen must in each case be submitted to the director of the graduate school for approval. The chosen subjects must bear an appropriate relation to each other.

A working knowledge of French and German is important for successful graduate work in practically all the major lines offered by the college, and students not having this will be given an opportunity to acquire it along with their graduate work.

The graduate staff reserves the privilege of recommending and allowing courses in other institutions as a part of the work for advanced degrees at this college, whenever such a policy seems advisable. A certain amount of work *in absentia* may also be permitted, provided it is prosecuted under satisfactory direction and supervision, and regular and sufficient reports of progress are submitted.

Thesis.

A thesis is required of each candidate for an advanced degree. It must be on a topic belonging to the candidate's major subject, must show that its writer possesses the ability to carry on constructive study, must be an actual contribution to knowledge, and possess real merit.

The thesis in its final form must be submitted to the director by June 1 of the year in which the student is to present himself for the advanced degree, and before he may take the required examination. Three complete copies are required. One of the copies is to be retained as an official copy by the director, one is to be deposited in the college library, and the third is to be retained by the department in which the thesis was prepared. The candidate for the doctor's degree must be prepared to defend at the oral examination the views presented in his thesis.

Final Examinations.

For the degree of doctor of philosophy or doctor of agriculture, final examinations on the minors taken are given upon the completion of the subjects. In the major subject, a written examination, if successfully passed, is followed by an oral examination in the presence of the graduate staff.

For the degree of master of science, master of agriculture, or master of landscape architecture, a final examination upon the minor taken is given upon the completion of each course, and in the major a final examination, which may be other written or oral, or both, is given over all the work by the department concerned.

Degrees Conferred.

The degrees of doctor of philosophy and doctor of agriculture are conferred upon graduate students who have met the following requirements: —

1. The devotion of at least three years[1] to the prosecution of three subjects of study and research in residence at the college.
2. The earning of not less than one hundred credits in the chief or major subject, and of not less than twenty-five credits in each of two minor subjects.
3. The preparation of a thesis, in the major subject, constituting an actual contribution to knowledge and accompanied by drawings if necessary. For the degree of doctor of agriculture the thesis may be modified to meet professional requirements.
4. The passing of final examinations, in both the major and minor subjects, to the satisfaction of the instructors in charge.
5. A public oral examination.
6. The payment of all fees and college expenses required.

[1] All time statements refer to minimum time.

The degrees of master of science, master of agriculture, and master of landscape architecture are conferred upon graduate students who have met the following requirements: —

1. The devotion of at least one year and a half to the prosecution of study in two subjects of study and research, not less than one full college year of which must be in residence. In the case of a master of landscape architecture the student must follow the prescribed course of study.
2. The earning of not less than fifty credits in the chief or major subject, and of not less than twenty-five credits in the minor subject. Students pursuing the course in landscape architecture will devote all of their time to the established course, and meet the conditions of one year of experience outside the college.
3. The preparation of a thesis in the major subject, constituting an actual contribution to knowledge, and accompanied by drawings if necessary.
4. The passing of final examinations, in both major and minor subjects, to the satisfaction of the professors in charge.
5. The payment of all fees and college expenses required.

The fee for the degree of master of science, master of agriculture, or master of landscape architecture is $10, and for the degree of doctor of agriculture, or doctor of philosophy, $25.

Courses Offered.

Courses available as major subjects for the degree of doctor of philosophy: —

Agricultural Economics.
Agronomy.
Bacteriology and Physiology.
Botany.
Chemistry.
Entomology.
Horticulture.
Pomology.
Rural Sociology.

Courses available as major subjects for the degree of master of science: —

Agricultural Economics.
Agricultural Education.
Animal Husbandry.
Agronomy.
Bacteriology and Physiology.
Botany.
Chemistry.
Dairy Industry.
Entomology.
Horticulture.
Pomology.
Poultry Science.
Rural Sociology.

Courses available as major subjects for the degree of master of agriculture: —

Agronomy. Animal Husbandry. Poultry Science.

The course in landscape architecture leads to the degree of master of landscape architecture.

Courses available as minor subjects: —

Agricultural Economics.
Agricultural Education.
Agronomy.
Animal Husbandry.
Bacteriology and Physiology.
Botany.
Chemistry.
Dairy Industry.
Entomology.
Horticulture.
Landscape Architecture.
Mathematics and Physics.
Pomology.
Poultry Science.
Rural Sociology.
Veterinary Science.
Zoölogy.

General Outline of Courses for Advanced Degrees.

Agricultural Economics.

Major Requirements.

For the Degree of Doctor of Philosophy.

Prerequisite Work. — Candidates must have had the following courses or their equivalent: Economics 25, Agricultural Economics 26 and 50.

Required Work. — Candidates must take the following courses: Agricultural Economics 51, 52, 53, and 79. These courses, specially arranged for graduates, may be taken as Courses 120, 170, 155, and 160 for graduate credit. In addition, candidates must take Courses 110, 111, 130, 165, and 175 in agricultural economics; Sociology 27 and 50, or equivalent courses; and Economics 51 and 52, or equivalent courses.

Each candidate will be required to have a working knowledge of the general field of economics, the history of agricultural economics, the theory of agricultural economics, the problems of agricultural production, land tenure, land problems, agricultural commerce, agricultural co-operation, agricultural credit, statistics of agriculture, and prices, markets, and marketing.

For the Degree of Master of Science.

Prerequisite Work. — The same as for the degree of doctor of philosophy.

Required Work. — The same as for the degree of doctor of philosophy, to a total of at least fifty credits.

Graduate Courses Offered.

110. Theory of Agricultural Economics. — Readings in French, German, and English on economics of agriculture. Alternate years, odd, 200 hours. Credit, 3.
Professor Cance.

111. Current Economic Problems and Literature. — Department seminar throughout the year. Credit, 1 each term.

120. Economic History of American Agriculture. — Spring term. Credit, 3.
The Department.

121–122. History of American Agriculture. — Special studies in the history of agricultural institutions, practices, or relations. Fall term, even years. Credit, 5.
Assistant Professor Jefferson.

130. Problems of Agricultural Production. — The relation of the farmer to the food supply. May be taken in connection with Course 77. Fall term, yearly. Credit, 5.
Professor Cance.

140. Land Tenure and the Acquisition of Farm Land. — Readings, discussion, original exercises. Alternate years, even. Credit, 3–5.
Professor Cance.

145. Farm Labor. — Reading and investigation. Credit, 3.
Professor Cance.

150. Agricultural Commerce, Industry and Trade. — A study of trade movements and commercial activities relating to agricultural products. Fall term, alternate years, odd. Credit, 3–5.
Assistant Professor Jefferson.

155. The Agricultural Market. — A study of the forces, methods, and institutions of the market for agricultural products. Spring term, yearly.
Credit, 5.
Professor Cance.

156. Specific Problems in Marketing Farm Products. — Reports and discussions. Alternate years, odd. Credit, 3.
Professor Cance.

160. Elementary Principles of Statistics. — Chiefly related to Agriculture. Lectures, laboratory studies, and original work. Taken in connection with Course 79. Fall term, yearly. Credit, 5.
Professor Lindsey.

161. Advanced Statistics. — Winter term, yearly. Credit, 3.
Professor Lindsey.

162. Agricultural Prices. — Spring term, yearly. Credit, 3.
Professor Lindsey.

163. Specific Problems in Statistics of Agriculture. — Alternate years, even. Credit, 3–5.
Professor Lindsey.

165. Transportation of Agricultural Products. — Elementary discussion and report. Winter term, yearly. Credit, 5.
Professor Cance.

166. Specific Transportation Problems. — Original study, reading, and report on certain transportation problems related to agriculture. Alternate years, odd. Credit, 3–5.
Professor Cance.

170. Co-operation in Agriculture. — Elementary problems and discussion. May be taken in connection with Course 52. Winter term, yearly. Credit, 5.
Professor Cance.

171–172. Special Problems in Co-operation for Economic Purposes. — study, original investigation, and discussion. Every third year, beginning 1922.
Credit, 3–5.
Professor Cance.

175. Agricultural Credit. — Readings and reports in addition to class lectures on agricultural credit. Taken in connection with Course 78. Spring term, yearly. Credit, 3–5.
Professor Lindsey.

185. Rural Law. — Corresponds to Course 75. Spring term, yearly.
Credit, 5.
Mr. Smart.

186. Studies in Agricultural Legislation. Credit, 3–5.
The Department.

190–195. Investigation of Various Problems related to Agricultural Economics. — Credit given on basis of time spent and reports submitted.

200. Thesis. — Research work in agricultural economics will be developed by four principal methods, namely, historical, statistical, accounting, and general field investigation. In all instances mastery of research methods includes facility in investigation, tabulation, and interpretation of results.

Minor Requirements.

Undergraduate prerequisites, 15 credit hours of economics and agricultural economics, including the following courses or their equivalents: Economics 25, Agricultural Economics 26 and 50.

Required work, Courses 111, 155, and 160, or equivalent courses.

Agricultural Education.

Major Requirements.

For the Degree of Master of Science.

Prerequisite Work. — A minimum of 25 undergraduate credits is required before beginning graduate study. These should be in the fields of philosophy, psychology and education. Successful teaching experience will receive consideration.

Required Work. — A minimum of 50 credits, including the thesis, is to be earned from the following list of courses. A reasonable amount of graduate credit may be accepted from other institutions of good standing for partial satisfaction of the required total. In no case shall Courses 51, 55, and 56 be taken by a graduate student for credit. The material of other undergraduate courses may be used by special arrangement provided the work earns a grade of B or over and has not been taken before for credit.

Graduate Courses Offered.

100. History of Education — Ancient and Medieval. — The development of education from the beginning of conscious educational practices to the close of the Middle Ages. Lectures, reading, reports, examination. Fall term.
Credit, 2–5.
Professor Glick.

102. History of Education — Modern. — A study of educational theory and practice during modern times. Lectures, discussion, reading, reports, examination. Fall term. Credit, 2–5.
Professor Glick.

104. Vocational Education. — Laws, rulings, policies, and plans of vocational education in the United States. Lectures, reading, discussion, examination. Summer term. Credit, 5.
The Department and
Vocational Division State Department of Education.

105. General Curriculum — Secondary Schools. — Principles and practices in curriculum determination. Lectures, reading, problem study, discussion, examination. Fall term. Credit, 5.
Professor Welles.

107. Special Curricula — Secondary Schools. — Studies of special type curricula in specific subjects. Lectures, reading, problem study, discussion, examination. Fall term. Credit, 2–5.
Professor Welles.

110. Rural Education. — May be general or special in character. Relates to aims, general character, curricula, and administration. Reading, problems, reports, examination. By arrangement. Credit, 2–5.
The Department.

115. Agricultural Teacher Training. — Has to do mostly with men in agricultural teaching service. Reading, conference, supervision of teaching. By arrangement. Credit, 3–5.
Professor Welles.

120. Intelligence and Aptitude Tests. — The theory and use of so-called intelligence tests and special aptitude tests. Lectures, discussions, reading, reports, laboratory work, examination. Spring term. Credit, 2–5.
Professor Glick.

122. Educational Tests. — The theory and use of standardized tests whose primary function is to measure school progress. Lectures, discussions, reading, reports, laboratory work, examination. Spring term. Credit, 2–5.
Professor Glick.

125. Senior High School: — Organization and Administration. — Lectures, reading, reports, examination. Winter term. Credit, 3.
Professor Welles.

127. Junior High School: — Organization and Administration. — Lectures, reading, reports, examination. Winter term. Credit, 3.
Professor Welles.

130. Advanced Educational Psychology. — This course affords opportunity for special study in any of the various phases of educational psychology. Lectures, reading, reports, experimentation, discussion, examination. Winter term. Credit, 2–10.
Professor Glick.

133. Philosophy and Ethics. — Given at present in the Summer School. As described in that catalogue. Credit, 3–5.
The Department.

135. Educational Philosophy. — Primary consideration is given to the various aims of education both from the standpoint of theory and practice. Lectures, reading, reports, discussion, examination. Winter term. Credit, 2–10.
Professor Glick.

140. Educational Seminar. — Studies of educational problems and topics primarily by the thesis method. Conference and thesis. By arrangement. Credit, 2–10.
The Department.

145. Advanced Method Studies. — May be general methods or special methods in particular subjects. Reading, conference, reports, examination. Spring term. Credit, 5–10.
Professor Welles.

147. Supervised Teaching. — A limited opportunity for the graduate student to teach his regular classes under critical observation. Reading, teaching, discussion, lectures. By arrangement. Credit, 3.
Professor Welles.

200. Thesis. — Original work on an educational problem for new information or new applications of old information. Investigation, tabulation, and interpretation. Statistical methods for exactness wherever possible. Credit, 15–25.
The Department.

Minor Requirements.

Minor work is offered by the department for advanced degrees. Candidates must have had a total of 15 credits in philosophy, psychology and education, as prerequisites.

Agronomy.

Major Requirements.

For the Degree of Doctor of Philosophy.

Prerequisite Work. — Candidates must have had the equivalent of undergraduate Courses 25 and 27 as described in this catalogue, and should have had thorough training in the elements of the natural sciences.

Required Work. — Studies will be assigned from the courses listed below. Thesis problems may be chosen in the subject matter of soils, fertilizers, or field crops.

The subject-matter content of the following courses is not fixed, but is determined in each individual case by the training, experience, and needs of the graduate student. This method permits a degree of flexibility which is conducive to the development of the individual capacity of the student.

For the Degree of Master of Science.

Prerequisite Work. — As above.

Required Work. — Assigned work will be selected from the courses listed below.

For the Degree of Master of Agriculture.

Prerequisite Work. — The same as for the degree of master of science in so far as it is essential to establish the professional approach to agronomy, but in addition the candidate must be familiar with agronomical practices.

Required Work. — As above.

Graduate Courses Offered.

110. Studies in the Culture of Field Crops. — Laboratory, field, or other problems concerning the tillage of field crops. Credit, 1–10.

115. The Fertilization of Field Crops. Credit, 1–10.

120. Studies in Harvesting and Storage. — Problems of method and time of harvesting and methods and conditions of storage, in relation to the keeping of field crops. Credit, 1–10.

125. The Improvement of Field Crops. — Readings, discussions, laboratory or field work in the improvement of field crops by breeding and selection. Credit, 1–10.

130. Technology of Field Crops. — The classification, grading, processing, and utilization of field crops. Credit, 1–10.

140. Soil Classification. — Laboratory, field, and library studies of methods and the principal groups, series, and types of soils. Credit, 1–10.

145. Studies in Soil Physics. — Problems concerning texture, structure, and other physical properties of soils. Credit, 1–10.

150. Moisture Relationships in Soils. — Readings and problems concerning the soil and moisture in their various relations. Credit, 1–10.

155. Studies in Soil Management. — Study of a wide range of problems arising in the management of soils for crop production. Credit, 1–10.

160. Soil Technology. — Includes studies and properties, behavior, and technical utilization of soils. Credit, 1–10.

165. Soil Reaction Studies. — Studies of hydrogen-ion concentration of soils as affected by natural agencies and conditions induced by practices of soil management. Credit, 1–10.

170. Studies of Soil Fertility. — Investigation of the factors and conditions affecting the productivity of soils. Credit, 1–10.

175. Organic Matter of the Soil. — Includes studies of the origin, properties, and methods of maintenance of soil organic matter, and its physical and biochemical relations to soil fertility. Credit, 1–10.

180. Fertilizer Technology. — Studies of the properties and behavior of fertilizer materials when unmixed with the soil. Credit, 1–10.

185. Fertilizers and the Soil. — Concerning the interrelationships of soils and fertilizers when mixed. Credit, 1–10.

190. Studies in Literature. — Practice in preparing abstracts and summaries of the literature bearing on selected topics. Credit, 1–10.

200. Thesis. Credit, 15–50.

Minor Requirements.

Prerequisites are as stated for major work. In addition studies suited to the needs of the candidate will be selected from the above courses.

Animal Husbandry.

Major Requirements.

For the Degree of Master of Science or Master of Agriculture.

Prerequisite Work. — Candidate must have had the following courses, or their equivalents, before he can enter graduate work in this department: Animal Husbandry 25, 26, 50, 52, 53, and 75. He should also be able to show evidence of experience in practical animal husbandry.

Required Work. — At least 50 credits must be earned from the following list of courses offered by the department.

Graduate Courses Offered.

100. Advanced Breed History. — Special study of the genetic and historical foundations of any modern breed of livestock and its developmental trends, accomplishments, and present status. Credit, 10.

110. Nutrition of Farm Animals. — An advanced course dealing with the nutritional physiology of animals and the chemistry of metabolism. Special emphasis is laid upon the role of proteins, minerals, and vitamines in the efficient production of animal products. Credit, 10.

120. Breeding of Farm Animals. — An advanced course dealing with the physiology of reproduction in domestic animals and with the laws of inheritance as evidenced through the various systems of breeding. The working of Mendelian principles in domestic animals is carefully considered. Credit, 10.

200. Thesis. — Research work in Animal Husbandry may consist of historical studies of the modern breeds of livestock, experimental studies in animal nutrition or breeding. Credit, 25.

Minor Requirements.

Minor work in animal husbandry may include undergraduate Courses 50, 53, 81, and such work in reading and compilation of material as the instructor may outline. Written examinations will be conducted at the completion of each term's work.

Bacteriology and Physiology.

Major Requirements.

For the Degree of Doctor of Philosophy.

Prerequisite Work. — Candidate must have had Courses 50, 51, 80, 81, and 82, or their equivalents, and Chemistry 51, 52, 53, or their equivalents, before he can enter upon graduate work.

Required Work. — Studies will be selected from the courses offered below. It will be the purpose of the department to distribute such studies among the courses offered in a manner to gain the greatest efficiency and a comprehensive knowledge of the entire field. The work will be conducted by prescribed readings, conferences, lectures, and laboratory exercises.

For the Degree of Master of Science.

Prerequisite Work. — The same as for the degree of doctor of philosophy.
Required Work. — Courses of a basic and applied character selected from the courses offered below which will prepare the student for effective effort.

Graduate Courses Offered.

100. History of Bacteriology. — Studies in the development of bacteriology from the late seventeenth century to the present time, especially planned to show the developments of bacteriology in relation to agriculture, public health, the arts, industry, and medicine. Credit, 1–5.

110. Physiological Studies on Bacterial Metabolism. — The study of physiological oxidations, biochemical changes, nitrification, ammonification, and biophysical phenomena associated with the functions of bacterial physiology. Credit, 5–20.

120. Agricultural Bacteriology. — Special lectures on bacteriology in relation to agricultural procedures. Open only to students well prepared in chemistry, soil, water, food, and dairy bacteriology, and having had Bacteriology 75 or its equivalent. Credit, 5–20.

130. Soil Bacteriology. — Accurate applications of microchemical methods are demonstrated. Biochemical and biophysical methods for measuring the physiological activities of soil microorganisms are studied. Nitrification, denitrification, and ammonification will be discussed in relation to their influence on soil fertility. Credit, 5–20.

140. Dairy Bacteriology. — Technical procedures used in establishing sanitation in relation to milk production and supply will be discussed. Modern methods involved in the preparation, control, and preservation of milk and dairy products are studied. Credit, 5–20.

150. Food Bacteriology. — Principles of food preservation and conservation; the application of scientific methods to the understanding of food fermentations and spoilage will be considered. This is arranged primarily for students with an excellent background in both chemistry and bacteriology. Credit, 5–20.

160. Hygienic Bacteriology. — Special consideration given to organization of disease control campaigns, laboratory management, the relationship of serology, immunology, and bacteriology to municipal, rural, and community health. Bacteriological, immunological, and serological procedures will be presented, and there will be discussion of problems showing their use for improving the condition and environment for human and animal life. Credit, 5–20.

170. Physiology, Human or Animal. — Given only to students who have had undergraduate Courses 63, 64, and 65, or their equivalents. Study of the physiology of the circulation with special reference to intermediate metabolism; to be followed by a course on the physiology of excretion. This course in physiology may be considered from the standpoint of human or animal physiology, according as the student may elect. Credit, 5–10.

190. Lectures and Study of Literature. Credit, 1 each term.

200. Thesis. — Some microbiological problem related to agriculture, food, or public health. Distributed as may be most beneficial for research work. Time and credit by arrangement. Credit, 15–50.

Minor Requirements.

Minor work in bacteriology may consist of undergraduate Courses 50, 51, 75, 80, 81, and 82 and other courses designed to support the major work, from among the courses offered above. The candidate will also be required to pursue graduate Course 190, or follow a course of reading and conferences through three terms. In case the candidate has had some of these courses, he will be required to take more advanced substitute courses.

Botany.

Major Requirements.

For the Degree of Doctor of Philosophy.

Prerequisite Work. — The equivalent of certain undergraduate courses, determined by the department in the case of each student, is prerequisite.

Required Work. — Candidates will be required to take Courses 100 through 107, and 180, 190, and 200. Courses 150 through 155 may be taken for graduate credit in certain cases. The maximum number of major credits which may be earned in this way is 29.

For the Degree of Master of Science.

Prerequisite Work. — The requirements are the same as for the degree of doctor of philosophy.

Required Work. — Candidates will take Courses 100 and 101, and all courses from 102 through 107 which are given during their term of residence, also 180, 190, and 200. In certain cases Courses 150 through 155 may be taken, but not more than 20 credits may be earned in this way.

Graduate Courses Offered.

Courses 100 through 106 are lecture courses. They are given in rotation, except Courses 100 and 101, which come every year.

100. Plant Physiology.— The lectures will consider, under the nutrition of the plant: its chemical structure, absorption of various nutrient substances and their changes in the plant, assimilation and dissimilation of carbon and nitrogen by autotrophic and heterotrophic plants; under changes in the form of plants: growth and form under constant external factors, the influence of variable external and inner factors on growth, form, and development; and under plant movements: the various tropisms, mutations, etc. Supplemental demonstrations, laboratory work, and readings in the standard texts and journals. One lecture a week for 36 weeks. Credit, 3.

101. Plant Pathology. — A general consideration of the history, nature, and causes of plant disease; parasitism, predisposition, immunity, degeneration, natural and artificial infection, dissemination, epidemics, biologic strains, monstrosities and malformations, proliferation, prevention and control, economies of plant diseases. One lecture a week for 36 weeks. Credit, 3.

102. Plant Inheritance. — This course is planned to give the student a comprehensive understanding of the principles and facts of plant inheritance. A study is made of plant variations, Mendel's law of heredity, the physical basis of heredity as established by chromosome behavior, pure lines, mutations, species and graft hybrids, etc. One lecture a week for 12 weeks. Credit, 1.

103. Biologic Relations. — Consideration of certain phases of the morphological and physiological adaptations of plants with regard to insect visits; the role of thorns, hairs, tendrils, glands, etc. Various experiments are made to test out experimentally some of the existing theories concerning biologic adaptations. One lecture a week for 12 weeks. Credit, 1.

104. The Ecology of Plants. — This course deals with the water, light, and temperature relations of plants, and the various adaptations in response to these factors; the various types of plant formation; the migration of plants; the competition of plants; invasion and successions of plants under varied conditions; and the various types of alterations and zonations. One lecture a week for 12 weeks. Credit, 1.

105. Physiological Plant Pathology. — This course considers those plant diseases not due to bacterial or fungous parasites, but resulting from unfavorable physical or chemical conditions of the soil; from harmful atmospheric influences, such as too dry air, too much moisture, hail, wind, lightning, frost; from injurious gases and liquids; from lack of or too much light; from wounds. A knowledge of the normal physiology of the plant is required. Demonstrations and laboratory work will be given, together with assigned readings. One lecture a week for 12 weeks. Credit, 1.

106. History of Botany. — An historical survey of the science; lives of noted botanists; history of certain culture plants, such as wheat, corn, coffee, potato, rice, and their influence on civilization; reading. One lecture a week for 24 weeks. Credit, 2.

107. Methods in Drawing and Photographing for Thesis and Publication. — Twelve weeks. Credit, 1–3.

108. The Comparative Anatomy of Green Plants. — See undergraduate Courses 61–63.

109. Systematic Botany of the Higher Plants. — See undergraduate Courses 58, 59, and 60.

150. Systematic Mycology. — See undergraduate Courses 52–53.

152. Plant Histology. — See undergraduate Course 55.

154. Plant Pathology. — See undergraduate Courses 75–77.

155. Plant Physiology. — See undergraduate Courses 78–80.

156. Plant Ecology. — See undergraduate Course 81.

180. Seminar. — A weekly seminar for members of the department staff, graduate students, and major senior students is held, at which important botanical papers are discussed. Attendance and participation are required. Credit, 3.

190. Collateral Reading. — Extensive reading of botanical literature in English, German, and French, designed to give the student a broad knowledge of the science is required of all major students. Final examinations are based in part upon this reading course. Credit, 5–10.

200. Thesis. — Each major student is required to select a problem in plant pathology or physiology (in other branches at the discretion of the department) for original investigation, and the thesis must embody a distinct contribution to knowledge. An effort will be made to assign problems having some bearing on scientific and economic agriculture. The thesis work counts for not more than 50 per cent of the total number of major credits required for either degree.

Minor Requirements.

For a minor a student may take such of the work offered by the department as seems best suited to his major course. Courses 150 and 155 are primarily undergraduate work which may be taken for minor credit toward advanced degrees. In most cases no problem will be assigned.

Professors Osmun, Clark, Torrey, and Davis.

Chemistry.

Major Requirements.

For the Degree of Doctor of Philosophy.

Prerequisite Work. — The candidate must have taken undergraduate Courses 1 to 87, or their equivalent.

Required Work. — The candidate will be required to take all the graduate courses listed below. He may also be required to spend at least one year at some other recognized institution, pursuing graduate study in chemistry. For the final examinations, questions will be selected from the entire field of chemistry, with special emphasis upon the lines of work covered by the research.

For the Degree of Master of Science.

Prerequisite Work. — Courses 1 to 63 required; 75 and 80 desirable.

Required Work. — Courses 101, 109, 110, 111, 112, 114; and 6 to 11 credits, according to the nature of the work, from Courses 102, 103, 104, 105, 106, except that if the candidate has not had Courses 75, 80, 86, and 87 these must be taken, and may be substituted for some of the Courses 102 to 106. The candidate must pass a final written and oral examination before the department upon undergraduate Courses 1 through 80, as well as upon all graduate work taken in chemistry.

Graduate Courses Offered.

101. Inorganic Preparations. — Laboratory. The preparation of chemical products from raw materials. The manufacture and testing of pure chemicals. The laboratory work is essentially synthetic in nature, and is designed to aid in acquiring a more adequate knowledge of inorganic chemistry than is to be obtained by chemical analysis alone. Any term. Credit, 3 or 5.

Assistant Professor Serex.

102. Advanced Inorganic Preparations. — Laboratory. Continuation of Course 101. Any term. Credit, 3 or 5.

Assistant Professor Serex.

103. Advanced Analytical Chemistry.— Laboratory. This course may be taken in part as follows: (a) electrolytic analysis, 6 credits; (b) ultimate analysis, 3 credits; (c) special analytical work to meet the needs of the individual student, 5 credits. In addition the following subjects may be taken, if desired: (d) fertilizers, 5 credits; (e) insecticides, 3 credits; (f) milk and butter, 5 credits; (a), (b), (c) may be taken any time; (d), (e), (f) should be taken at the time the undergraduate course is given.

Professor Peters.

104. Advanced Physical Chemistry. — Laboratory. Measurement of the electrical conductivity of solutions; degree of ionization; ionization constants; per cent hydrolysis of aniline hydrochloride from conductivity measurements; solubility product by the conductivity method; velocity of saponification by conductivity; neutralization point by conductivity; vapor pressure determinations; critical temperature of carbon dioxide or sulphur dioxide; transport numbers; preparation and properties of colloidal solutions; transition points by dilatometric method; heat of solution of ammonium chloride and potassium nitrate; adsorption of iodine by charcoal; determination of hydrogen ion concentration. To each student separate work will be assigned. Any term. Credit, 5.

Assistant Professor Serex.

105. Advanced Organic Chemistry. — Laboratory. The preparation of compounds not included in Courses 51, 52, 53, such as the Kolbe synthesis of salicylic acid; benzaphenone and Beckmann's rearrangement; rosaniline, malachite green, Congo red, indigo, and other dyes; synthesis of fructose; Grignard reaction. To each student separate work will be assigned. Any term. Credit, 5.

Dr. Cupery.

106. Advanced Physiological and Food Chemistry. — Laboratory. An intensive study of some of the more important physiological processes, physiological compounds, or food ingredients. Studies of milk, blood, urine, or other physiological factors under various metabolic and pathologic conditions. To each student separate work will be assigned. Any term. Credit, 5. Prerequisite, Chemistry 80.

Dr. Cupery.

109. Theoretical or Analytical Chemistry. — Lectures. A study of the development of the electron conception of valence; the structure and size and compressibility of atoms. A general survey of the analytical processes and the theory underlying. Third term. Subjects alternate annually. Credit, 1.

Professor Peters.

110. Organic Chemistry. — Lectures. Some of the following topics will be considered both theoretically and industrially; alkaloids, synthetic dyes, essential oils, terpenes, rubber, cellulose; the study of methods for carrying out general reactions; isomerism, tautomerism, condensation, etc. First term. Subjects alternate annually. Credit, 1.

Dr. Cupery.

111. Advanced Physiological and Food Chemistry. — Lectures. A study of the recent advances in this field. An intimate treatment of the more important physiological factors and their relations to health, nutrition, and growth. Second term. Subjects alternate annually. Credit, 1.

Dr. Cupery.

112. Theoretical and Physical Chemistry. — Lectures. A general outline of special topics selected from recent publications covering theoretical and physical chemistry. Third term. Subjects alternate annually. Credit, 1.

Assistant Professor Serex.

114. Seminar. — Conferences, reports, or lectures. Each term, once a week. Credit, 1.

Professor Lindsey.

200. Thesis. — Research, and, in the case of a degree, the preparation of an acceptable thesis in agricultral, analytical, organic, physiological, or physical chemistry, under the direction of the professor in charge of the work. Credit determined by work done.

Minor Requirements.

Work may be selected from any of the undergraduate Courses 57 to 87, or any of the graduate courses for which the student is prepared. In addition, the candidate may be required to pass a final written and oral examination before the department upon his entire minor work.

Dairy Industry.

Major Requirements.

For the Degree of Master of Science.

Prerequisite Work. — Undergraduate courses: Physics 25, 26, and 27; Bacteriology 50, 51, and 80; Chemistry 30 and 81, and prerequisite work; Dairy 50, 51, 52, 75, 76, 77, 78, 79, and 80 will be required for graduate work, and any student who has not passed these courses or their equivalent will be required to make up such work without graduate credit.

Required Work. — Studies will be assigned from courses listed below or from correlated work in other departments.

Graduate Courses Offered.

101. History and Development of Dairying. — A review of the early history of dairying and factors in the industry contributing to its present development. Credit, 3–10.

102. Ice Cream Problems. — A study of existing scientific, technical, and marketing problems in the field of ice cream making. Credit, 2–10.

103. Market Milk Problems. — Consideration of production, processing, and distribution of milk, the nutritional value of milk, chemical and bacteriological aspects of milk handling. Credit, 2–10.

104. Surplus Milk Problems. — The economical disposal of seasonal surpluses through cheeses, butter, milk drinks, etc. Credit 2–10.

105. Dairy Plant Management. — The selection, construction, and arrangement of dairies and dairy machinery, and economical operation of same. Credit, 2–10.

195. Seminar. Credit, 1–2.

200. Thesis. — Original research work having a bearing on some important problem in dairying. Credit, 15–25.

Minor Requirements.

Minor work in Dairy Industry may include undergraduate Courses 52, 75, 76, 78, and such other work as the instructor may outline. Written examinations are required at the completion of each term's work.

Entomology.

Major Requirements.

For the Degree of Doctor of Philosophy.

Prerequisite Work. — The candidate must have taken undergraduate Courses 26, 28, 52, 53, 55, 57, 75, 76, 77, 78, and 79 or their equivalent. Opportunities to make up any deficiencies will be available while the graduate work is being carried on.

Required Work. — Courses from the list below, consisting of lectures, laboratory work, advanced readings, seminar, and thesis.

For the Degree of Master of Science.

Prerequisite Work. — The same as for the degree of doctor of philosophy.

Required Work. — A major course for the master of science degree will consist of subjects from the list below selected as far as possible to meet any special needs of the candidate, and will be about half of the work required for the doctor of philosophy degree.

Graduate Courses Offered.

As these courses vary from a few exercises only to half a year or more, no fixed number of credits can be assigned to them.

Morphology.— 101–120.

101. Embryonic development of insects and polyembryony.
Professor Crampton.

102. Metamorphosis and its interpretations.
Professor Crampton.

103. Advanced external and internal anatomy.
Professor Crampton.

104. Insect histology and physiology.
Professor Crampton.

105. Ancestry and development of insects, including fossil forms.
Professor Crampton.

106. Hermaphroditism in insects.
Professor Alexander.

107. Hybrids.
Professor Crampton.

108. Parthenogenesis, pedogenesis, and heterogeny.
Professor Crampton.

109. Chemistry and physics of insect colors.
Assistant Professor Sweetman.

110. Color patterns, their significance and value.
Assistant Professor Sweetman.

111. Luminosity.
The Department.

112. Insect teratology.
Professor Alexander.

113. Variation in insects.
Professor Alexander.

Ecology. — 121–140.

121. Dimorphism and polymorphism.
Professor Alexander.

122. Mimicry, including concealment, protective devices, and warning coloration.
Professor Crampton.

123. Architecture of insect structures.
Professor Crampton.

124. Relation of insects to plant fertilization and its importance.
Professor Crampton.

125. Insect products of value to man.
Professor Crampton.

126. Geographic distribution and methods of distribution of insects, with consideration of life zones, barriers, etc.
Professor Alexander.

127. Insect migrations.
Professor Alexander.

128. Insect behavior and experimental entomology.
Professor Crampton.

129. Enemies of insects.
Assistant Professor Sweetman.

130. Duration of life.
Assistant Professor Sweetman.

Economic Entomology. — 141–160.

141. Control methods.
Assistant Professor Sweetman.

142. Insect photography and methods of preparing illustrations.
Assistant Professor Sweetman.

143. Field work and life history investigations, with methods for keeping records.
Assistant Professor Sweetman.

144. Legislation about insects.
Assistant Professor Sweetman.

145. Studies of insecticides and their application.
Assistant Professor Sweetman.

146. Insectary methods.
The Department.

147. Biological control of insects.
The Department.

Systematic Entomology. — 161–179.

161. History of entomology and of classifications.
Professor Crampton.

162. Lives and works of prominent entomolgists.
Professor Alexander.

163. Abundance of insects.
Professor Alexander.

164. Important collections, public and private; their location and their value.
Professor Alexander.

165. Types of insects; their significance, importance, and location.
Professor Alexander.

166. Rules of nomenclature and how they are used.
Professor Alexander.

167. Methods for collecting, preparing, perserving, and shipping insects.
Professor Alexander.

180. Seminar. — Reports on the current literature of entomology; special reports; monthly meetings.

190. Advanced and Collateral Readings. — The best articles on various topics in entomology are assigned for study, and the subjects are included in the final examinations.

200. Thesis. — Original research on one or several topics in morphology, ecology, economic and systematic entomology. This may require from one-half to two-thirds of the total working time of the student.

Minor Requirements.

Minor courses will cover such parts of the work outlined above as will be most likely to prove useful in connection with the majors taken by the students, or in their future work. It is not required that such men shall have had all the undergraduate work in entomology given at this college, their credit for a minor beginning where their own undergraduate training in the subject ended.

Horticulture.

Graduate work is offered in various lines of horticulture. For the most part this is divided into the different departments which constitute the college Division of Horticulture, as follows: pomology, floriculture, landscape gardening, forestry, and market gardening. For work in these lines application should be made direct to the heads of the several departments.

Besides this work, however, opportunity is offered for graduate study in general horticulture, including topics from the several organized departments mentioned, and also questions relating to plant breeding, general evolution, propagation, manufacture of horticultural products, etc. This general work is under the direction of Professor Waugh, head of the Division of Horticulture.

Landscape Architecture.

Major Requirements.

For the Degree of Master of Landscape Architecture.

Prerequisite Work. — 1. The undergraduate courses in the college known as Landscape Gardening 50, 51, and 52; Drawing 25, 26, and 27; Horticulture 50 and 51, and Mathematics 26 and 27 will be considered prerequisite, and any student who has not passed these courses, or their equivalent, will be required to make up such work without graduate credit.

2. Each student before he may receive the master's degree with a major in this department must convince his instructors that he has a genuine aptitude for some branch of landscape architecture, either in design, construction, or management.

3. The minimum period of graduate study will be one and one-half years. At least one year of this time must be spent in residence at the college. One year

must also be spent in practice outside of the college. The work done outside the college may be prescribed by the department, and must be fully reported to the department in writing. It is essential, further, that the candidate secure the written approval of his employers outside the college. The department may, at its discretion, require a longer period of study at the college or a longer apprenticeship outside the college.

4. Every student before receiving his master's degree in landscape architecture must have given some thorough and fruitful study to each of the principal branches of the subject, *viz.*, theory, design, architecture, construction, maintenance, and office practice. As far as possible these studies will be of a practical nature, that is, they must be made upon going projects.

5. While great freedom is allowed to graduate students in their plans of work, a certain portion of time will always be given to systematic courses in instruction. Courses known as Landscape Gardening 75, 76, 78, 79, 81, and 82 are required, and may or may not be accepted for graduate credit, at the discretion of the department.

Graduate Courses Offered.

190. Theory. — Special studies in the history and theory of art and of landscape architecture. Credit, 2–10.
The Department.

191. Design. — Individual problems in any or all branches of design, including estates, parks, playgrounds, public grounds, etc. Credit, 2–10.
The Department.

192. Construction. — Individual problems by arrangement, including engineering, estimating, cost accounting, and methods of construction.
Credit, 2–10.
The Department.

193. Maintenance. — Special studies, experimental work of assigned problems in various forms of grounds maintenance, costs, and methods. Credit, 2–10.
The Department.

194. Practice. — Professional field work under supervision, conducted upon going projects as opportunity offers. By arrangement. Credit, 2–10.
The Department.

195. Seminar. — Regular meetings for conference. Credit, 1–5.
Professor Waugh.

200. Thesis. — Each student before receiving the master's degree with a major in landscape architecture must present a satisfactory thesis or complete project. A thesis will consist of a careful original study of some problem in landscape architecture presented in typewritten form with any necessary illustrations, such as photographs, diagrams, drawings, etc. A project will consist of a completed set of studies of some suitable landscape-gardening problem, such as the design of a park, a real estate subdivision, an extensive playground. Such a project will usually consist of —

(*a*) Original surveys, including topography.
(*b*) Block plans, showing original design.
(*c*) A rendered plan or plans of the main features.
(*d*) Detailed working drawings.
(*e*) Estimates of cost.
(*f*) Complete report and letter of transmittal.

Credit, 5–20.

Minor Requirements.

Any student electing a minor in landscape architecture will be directed to take such courses from the regular catalogue list as may seem most suitable to him.

Under ordinary circumstances no other work will be given to students electing minors. In special cases, however, individual problems will be assigned and individual instruction given. These exceptions will be made in cases where by so doing, it is possible to give the student material assistance in the plan of his major work.

Mathematics and Physics.

No regularly outlined major in mathematics and physics is offered at present but such a course may be arranged for individual students. As a minor, work in these subjects is available and would be selected in the lines most needed by the student in connection with his major work in each case.

The requirement of 25 credits for a minor may be taken in either subject or divided between them.

Pomology.

Major Requirements.

For the Degree of Doctor of Philosophy.

Prerequisite Work.—Candidates must have had the equivalent of the courses required for graduation from this college, also sufficient practical experience to enable them to understand and appreciate the problems of orchard practice.

Required Work. — The work outlined below will be required of all candidates.

For the Degree of Master of Science.

Prerequisite Work. — The same as for the degree of doctor of philosophy.

Required Work. — One-half of the work outlined below, selected to meet the needs of the individual student, will be required.

Graduate Courses Offered.

101. Experimental Methods. Credit, 15–20.

A critical study of the methods of research that have been used or may be helpful in pomological work. The following topics will be considered from the point of view of the investigator in pomology.

1. Statistical methods.
2. Measures of growth and yield.
3. The conduct of plot experiments.
4. Methods of soil study in their relation to pomological research.
5. Chemical methods of pomological research.
6. Methods of physiology applicable to fruit plants.
7. Microchemistry.

102. Pomological Research. Credit, 15–20.

A critical survey of past and current research work in pomology. Semi-weekly meetings for reports and discussions will be held. The following topics will be taken up:

1. Orchard soil management.
2. Soil fertility and fertilizers.
3. Physiology of pruning tree fruits and bush and vine fruits.
4. Fruit bud differentiation.
5. Sterility and fertility.
6. Genetics of fruit plants.
7. Climatology and winter injury.
8. Advanced morphology.
9. Spraying machinery and equipment.
10. Special practices.

103. Advanced Laboratory Work. Credit, 5–12.

Each student will be required to become familiar with the research work of the department and to have a share in it. So far as this has value as graduate work, he will receive credit.

104. History of Pomology. Credit, 2–5.
The men, institutions, and other influences that have contributed to the development of the science and art of pomology.

105. Horticultural Taxonomy. Credit, 2–3.
A study of the history and development of plant classification with special reference to horticultural plants. A study of modern classification carries with it an expression of opinion as to the evolution of cultivated plants.

106. Advanced Systematic Pomology. Credit, 6–10.
The principles of systematic pomology including a study of nut and subtropical fruits not usually dealt with in undergraduate courses. Opportunity is also offered for study of leaf and general tree characters of nursery and orchard trees and the relationship of varieties as indicated by these characters as well as those of the fruit.

200. Thesis. Credit, 40–50.
Each student will be required to carry out an original investigation of an assigned problem. In planning, executing, and interpreting the data of this problem he must show marked ability. The results are embodied in a thesis to be passed upon by the Department and the Graduate Staff.

Minor Requirements.

Students taking a minor in pomology will select such of the above courses as may be suited to their needs. Certain advanced undergraduate courses may also be taken for minor credit.

Poultry Science.

Major Requirements.

For the Degree of Master of Science or Master of Agriculture.

Prerequisite Work. — The postgraduate course presupposes all undergraduate work or its equivalent, together with practical experience. Without the latter, students will be unable to handle Courses 140, 150, and 160. At the discretion of the instructor in charge, graduate students may be required to pursue undergraduate courses in other departments without credit.

Required Work. — All the courses listed below. Practical poultry work may be required, but no credit will be given for such work.

Graduate Courses Offered.

101. Science of Poultry Husbandry. — A review of the entire field of poultry literature, including books, bulletins, journals, and other special articles. A written report on one or more subjects is required.

110. Poultry Problems and Literature. — A critical review and a criticism of the more important experiments carried on at various stations in this and other countries; also a study of poultry conditions in foreign countries, methods of management, etc., besides a detailed study of some of the largest poultry projects in this country.

120. Anatomy (Gross and Histological), Physiology, and Surgery. — This course requires a careful study of the anatomy and physiology of the fowl. Special attention is given to a study of those structures concerned with practical poultry problems. Instruction in surgical technique, adapted to fowls, may also be given.

130. Breeding. — The student will carry on such breeding experiments as time and facilities permit. He may also do work in connection with our regular experimental projects. A detailed study of the pertinent literature will be required. Animal Husbandry 53, or its equivalent, is a prerequisite.

140. Feeding and Nutrition. — A study of the relation of various feeds to the morphology and physiology of the fowl. Special attention is given to the effects of various nutrients on growth, sexual maturity, egg production, character of plumage, and condition of flesh. Complete rations as well as methods of feeding are fully considered.

150. Brooding. — Studies will be made upon the relation between viability and rate of growth and the following topics: type of brooder, number of chicks in brood, ventilation, humidity, sanitation, exercise, and weather conditions; also a comparison of natural methods with artificial methods of rearing chicks.

160. Incubation and Embryology. — A number of problems of a practical, scientific, and mechanical nature relating to incubation are considered. The work in embryology is of an advanced nature, dealing with its relation to morphogenesis and heredity, and presupposes an elementary knowledge of the embryology of the chick.

170. Poultry Diseases and Sanitation. — In this course a study is made of various problems in poultry sanitation, with particular reference to methods relating to the control and eradication of disease.

200. Thesis. — Research work may be carried out in the following lines: breeding, nutrition, brooding and incubation, and embryology. Originality and thoroughness are particularly emphasized.

Minor Requirements.

Courses 101 and 110 are designed particularly for minors.

Rural Sociology.

Major Requirements.

For the Degree of Doctor of Philosophy.

Prerequisite Work. — Candidates must take, or pass by satisfactory examination, the following courses: Sociology 27, 50, 51, and 52.

Required Work. — Candidates will be required to select from the courses listed below a field for investigation and intensive study. Candidates for the doctorate must earn one hundred credits in a major field.

For the Degree of Master of Science.

Prerequisite Work. — The same as for the degree of doctor of philosophy.

Required Work. — Not less than fifty credit hours are required in a major subject.

Graduate Courses Offered.

150. Forms and Theories of Government. Credit, 3.
Professor Mackimmie.

151. Modern European History. Credit, 3.
Professor Mackimmie.

152. Contemporary Civilization. Credit, 3.
Professor Mackimmie.

154. Civilization and Culture. — A study of human social and cultural development, including agricultural, with reference to the sources of our knowledge; attention is given to the results of recent scholarship in this field.
Credit, 5.
Assistant Professor Cutler.

175. Social Reforms. — An appraisal of present-day efforts to adjust our social conditions, in country and city, to the situation created by the industrial revolution; a study is made of recent literature on this subject. Credit, 5.
Assistant Professor Cutler.

177. Field Work of an Investigational Nature. — Research methods employed by sociologists — measurements, exploration, criticism, surveys; scientific value of the representative sample; quantitative measurements versus observation, comparison, and correlation; scholarly application of research methods by members of the class. Credit, 3.
Assistant Professor Cutler.

178. Sociological Surveys. — The survey in actual practice; the bird's-eye view; the segmental survey; measurement; causation; reporting and publishing the findings. Credit, 3.
Assistant Professor Cutler.

179–181. Seminar. — The seminar described under Sociology 79, 80, and 81. Graduate students render reports on research in which they engage, and upon selected portions of current sociological literature. The reports serve as the basis for general discussion. Credit, 3.

Professors Mackimmie and Cutler.

182. Social Conditions of American Rural Life. — Social and economic factors in rural progress; farm income and farm life. Credit, 3.
Assistant Professor Cutler.

183. Social Conditions of Old World Rural Life. — A sociological investigation of rural life in Europe, the Orient, and the Far East; rural co-operative enterprise in Denmark; agriculture in China after one hundred twenty generations. Credit, 3.
Assistant Professor Cutler.

184. Institutions of Business and Industry. Credit, 5.
Professor Mackimmie.

185. Organization of Public and Private Finance. Credit, 5.
Professor Mackimmie.

186. Farmers' Organizations. — A study of social and economic co-operation. Credit, 3.
Assistant Professor Cutler.

187. Town and Village Rural Life. — The agricultural village; the small town in relationship to its environing neighborhoods. Credit, 3.
Assistant Professor Cutler.

190. Rural Government. — Proposed improvements in rural local government. Credit, 3.
Assistant Professor Cutler.

191. Rural Leadership. — Qualities and methods making for successful leadership in rural communities. Credit, 3.
Assistant Professor Cutler.

192. Rural Conditions in the Caribbean Region. — A sociological study of rural life and industry in the American possessions and protectorates; relation of the West Indies to the United States. Credit, 3.
Assistant Professor Cutler.

193. The League of Nations and Agriculture. — Agricultural problems in their international aspects. Credit, 3.
Assistant Professor Cutler.

200. Thesis. Upon an approved subject, and must be a valuable contribution to knowledge. Especial stress is laid upon the feature of originality in the case of candidates for the doctorate.
Credit, for master's degree, 25; for doctor's degree, 50.

Minor Requirements.

Minor work in Rural Sociology is available, but its nature must of necessity be determined in each case by conference with the person concerned. A certain amount of undergraduate work in the subject may occupy a part of the time.

Veterinary Science.

Animal Pathology.

A minor consisting of two graduate courses (10 credits) in animal pathology, together with undergraduate courses (15 credits) in veterinary science, or bacteriology and physiology (see pages 66–68), is offered by this department.

120. General Pathology. — Arranged to meet the need of graduate students who have not pursued a course in general pathology. Reviews in gross and microscopic animal anatomy, followed by demonstrations and discussions on morbid anatomical phases of pathology (pathological histology). A written examination will be given at the end of the term. Winter term. Credit, 5.

140. Laboratory Methods of Diagnosis in Veterinary Science. — This course will consider bacteriological, biochemical, and serological methods now used as aids in animal pathology and in the diagnosis of animal diseases. Especial emphasis will be placed upon laboratory management, interpretation and classification of laboratory data, and the relationship of laboratory work to epizoötics, epidemics, and the public health. A written examination will be given at the end of the term. Spring term. Credit, 5.
Not offered in 1930–31.

Zoology and Geology.

Courses in zoölogy and geology may be available in connection with the fulfillment of requirements in a minor for an advanced degree. The nature of the work will vary according to circumstances, and may be intensive in a special field or of somewhat general character, depending upon the student's needs and his knowledge of either one of the subjects herein offered, in which he may wish to study further.

The Summer School.

The summer session offers courses of college grade only. Both undergraduate and graduate courses are given, intended for school superintendents, normal school, high school, college, and university teachers, college undergraduates, and any other serious student who is suitably prepared. When satisfactorily completed, these courses carry college credit.

Admission.

There are no formal examinations for admission to the summer school. Undergraduate students are admitted to such courses as their preparation justifies. Admission to the graduate school will be granted to graduates of the Massachusetts Agricultural College and to the graduates of other institutions having substantially equivalent requirements for the bachelor's degree.

The following schedule of courses, given in the summer of 1930, indicates the character and extent of the work, but is subject to modification.

General Bacteriology
Business Law
Principles and Methods of Teaching
History of Education
Introduction to Psychology
Educational Psychology
Secondary Education
Special Methods in Teaching Vocational Agriculture
Tests and Measurements
Oral English in the High School
Experimental Psychology
Types of Modern Philosophy
The Employed Teacher of Agriculture
Vocational Education
Survey of English Literature
Practical Public Speaking
American Literature
The American Short Story
Dramatic Presentation
Garden Flowers and Bedding Plants
Flower Arrangement
Nutrition and Dietetics
Methods of Teaching Nutrition
Plant Materials
Preparatory Algebra
Plane Trigonometry
Public Health
Introduction to Sociology

Fees.

The tuition fee for undergraduate work in the summer session is ten dollars together with a recreation fee of three dollars, and laboratory fees in certain courses. There are no tuition or laboratory fees for students registered in the Graduate School as candidates for advanced degrees at the Massachusetts Agricultural College. For other graduate students the usual Summer School expenses of tuition, special fees and auditor's fee will be collected.

For further information, write or apply to Roland H. Verbeck, Director of Short Courses, Massachusetts Agricultural College, Amherst, Mass.

For information concerning graduate work in the summer school, write or apply to Fred J. Sievers, Director of the Graduate School, Massachusetts Agricultural College, Amherst, Mass.

Non-Degree Courses of Instruction.

THE STOCKBRIDGE SCHOOL OF AGRICULTURE.

General Information.

The Stockbridge School of Agriculture was organized in 1918, under the name of "The Two-Year Course in Practical Agriculture," for the purpose of meeting the demand for a short course in agriculture which might be taken by students who could not satisfy college entrance requirements or who, for one reason or another, were unable to take the college course. The name was changed to the present one by vote of the trustees of the college in 1928.

Since its organization the school has registered over 1,300 students and now has over 700 graduates located largely in Massachusetts but found also throughout New England and in many other states of the Union. More than 200 students were registered in the school during the year 1929–30. This course trains men and women for the practice of farming or associated agricultural industries. Graduation from it does not fulfill the requirements for entrance into the degree course nor are credits earned during the course transferable toward credit for a degree.

As the course is now organized, students may specialize in any one of seven vocations: animal husbandry, dairy manufactures, floriculture, horticulture, fruit growing, poultry husbandry or vegetable gardening. Specialization in a vocation does not prevent students from securing a general working knowledge of other subjects. The Stockbridge School will appeal not only to young men and women, but also to men and women of mature years and practical experience who wish to know more about the business of farming or associated agricultural industries. The School is not intended for students enrolled in a high school; such students should complete their high-school course before seeking admission to this school.

Entrance Requirements.

Applicants for admission must be at least seventeen years of age and must have completed at least an elementary school course or its equivalent. Before being enrolled for the work of the second year, students must have completed six months' practical experience approved by the supervisor of placement training.

Students who are already enrolled in high schools and who wish to enter this school before the completion of the high-school course should bring a statement, either from the principal of the high school or from the parent or guardian, requesting enrolment.

Instruction.

The instruction is given by the regular faculty by means of classroom teaching, laboratory exercises, and practical work. The work of the classroom is supplemented by demonstration work in the laboratory, dairy room, greenhouse, and stables, and by a six months' period of farm placement training during the spring and summer following the second term of resident instruction. The course is designed to offer plain, practical, direct information, and to establish the underlying reasons for, as well as methods employed in, the various operations.

Credit and Diploma.

In order to obtain a diploma, the student must complete satisfactorily all the work required in the vocational course which he has selected. This course consists of five terms of class and laboratory instruction, supplemented by six months

of practical experience gained between the second and third terms of resident instruction and subject to the approval of the supervisor of placement training. No student failing to meet the requirements of his six months' summer training can be enrolled for the three terms of the second year, since he is not entitled to the diploma of the School.

Graduates of county schools of agriculture or of agricultural departments of high schools may complete the course for a diploma in one year if they are recommended by the director of the county school or by the instructor in charge of the department of agriculture in the high school.

Special Catalog.

For a complete catalog of the Stockbridge School of Agriculture, containing an application blank, write or apply to Director Roland H. Verbeck, Massachusetts Agricultural College, Amherst, Mass.

THE WINTER SCHOOL.

Short Courses are based on the idea that the motive which inspires study is the most significant factor in study itself, and that this motive rises when the student himself realizes he faces a problem that calls for a solution. Therefore, there is no age limit. Enrolled in short courses are found the young and the old, the experienced and the inexperienced, the theoretical and the practical. In this grouping there is a value, since students learn from each other as well as from the instructors. Practically all Short Course students intend to make a direct application of the knowledge gained. Hence the aim of Short Course work is to offer the largest amount of information and training in agricultural and horticultural lines in the shortest possible time. During the past twenty years Short Courses have served hundreds of students in this Commonwealth, and the demand for these courses in recent years has steadily continued.

The Winter School has been established for a number of years at the college, and has proved to be very popular with farmers, their wives, sons, and daughters, teachers, college graduates, and others. This school begins about the first of January. Instruction will be offered this year in—

Ten Weeks' Practical and Scientific Course for Florists. (Given on alternate years, — next year, 1932.)

Ten Weeks' Course in General Farming (Including dairy farming and fruit growing).

Ten Weeks' Course in Greenkeeping.

Ten Weeks' Course in Poultry Raising.

A series of special one-week courses in ice cream making, butter making, milk testing, and market milk are offered. During the one week the student devotes all of his time to the work of the special course in which he has enrolled. The instruction lasts throughout the day from 8 to 5. These courses meet a very definite need in the State for those who wish instruction, but who cannot attend for a longer period of time, and who do not wish to take other subjects.

Fees.

For all students taking the full ten-weeks term of the Winter School there is a tuition fee of $10 and, in addition, a registration fee of $5. There are no laboratory fees in connection with any of the courses.

For further information, write or apply to Roland H. Verbeck, Director of Short Courses, Massachusetts Agricultural College, Amherst, Mass.

DEGREES CONFERRED — 1930.

Doctor of Philosophy (Ph.D.).

Richmond, Edward Avery, B.S., Dartmouth; M.A., Cornell . . . Riverton, N. J.
Salman, Kenneth Allen, B.S., Massachusetts Agricultural College . . Amherst.
Sweetman, Harvey Leroy, B.S., Colorado Agricultural College; M.S., Iowa State College Las Animas, Colo.

Master of Science (M.S.).

Albro, Gardner Mills, B.S., Rhode Island State College . . . Newport, R. I.
Carpenter, David Frederic, B.S., Massachusetts Agricultural College . Millers Falls.
Clark, Hermon Richard, B.S., University of Maine Springfield.
Crooks, George Chapman, A.B., Amherst College Amherst.
Knudsen, Harold Raymond, B.S., Brigham Young University . . Amherst.
Ladas, Constantine Pericles, B.S., Massachusetts Agricultural College . Boston.
Landry, Herbert Adolphus, B.M.E., Northeastern University . . West Springfield.
Morse, Miriam, B.S., St. Lawrence University New Braintree.
Newton, Richard Carl, B.S., Connecticut Agricultural College . . Middletown, Conn.
Plantinga, Oliver Samuel, B.S., Massachusetts Agricultural College . Amherst.
Plantinga, Sarah Theodora, B.S., Massachusetts Agricultural College . Amherst.
Smith, Walter Russell, B.S., Massachusetts Agricultural College . Holden.
Stitt, Rhea Emerson, B.S., South Dakota State College . . . Huron, S. Dak.
Stewart, Sarah Elizabeth, B.S., New Mexico Agricultural College . Las Cruces, N. Mex.
VanMeter, Ralph Albert, B.S., Ohio State University . . . Amherst.

Bachelor of Science (B.S.).

Allen, Herbert Adams Fitchburg.
Ames, Winthrop Ashley Amherst.
Andrew, John Albion, Jr. West Boxford.
Armstrong, Robert Lindsay East Sandwich.
Atwood, Rachel Greenfield.
Babson, Osman Gloucester.
Bedford, Harry Sager Whitinsville.
Benoit, Edward George Chicopee Falls.
Bergan, Carl Augustus Northampton.
Bernard, Sergius Joseph North Adams.
Billings, Samuel Clark Belmont.
Bishop, Frank Millard Natick.
Bond, Richard Henry, Jr. Needham.
Brackley, Floyd Earle Strong, Me.
Brown, Mildred Shepard North Amherst
Buckler, May Frances Pittsfield.
Burbank, Oscar Frank, Jr. Worcester.
Call, Reuben Hillman Colrain.
Campbell, Harold Vining Leyden.
Cleveland, Maurice Mortimer East Pepperell.
Cook, Charles Hardy Beverly.
Coven, Milton Isadore Springfield.
Cox, Adelbert Winters Framingham.
Cox, Charles Bartlett Boston.
Cunningham, James Hugh Grey Quincy.
(As of the Class of 1929)
Davis, Gertrude Jordan Auburndale.
Day, William Albert Palmer Watertown.
Dean, Lucien Wesley Millis.
Decker, Charlotte Marthe Holyoke.
Denny, Mertle Althea Northampton.
Denton, Edward Wemyss Framingham.
Donovan, Margaret Pauline Bondsville.
Dover, Evelyn Methuen.
Drew, William Brooks Belmont.
Dutton, George Wallace Carlisle.
Ellert, Frederick Charles Holyoke.
Elliot, Davis Haskins South Westport.
Frame, Charles Frederick Rockland.
Gagliarducci, Anthony Lewis Springfield.
Gaumond, Alice Delimen Southbridge.
Goodell, Herbert Andrew Southbridge.
Goodell, Hermon Ulysses Southbridge.
Goodnow, Robert Gibson Mendon.
Graves, Arthur Hall Ashfield.
Grunwaldt, Lucy Antoinette Springfield.
Gunn, Ralph Ellis South Jacksonville, Fla.
Hammond, Clarence Elliot Needham.
Harris, Charles Whitcomb, Jr. Leominster.
Haubenreiser, Elsie Martha Springfield.
Hernan, Richard Alden Gilbertville.
Hetherington, Thomas Fall River.
Hinchey, Anne Elizabeth Palmer.
Howard, Lucius Alexander Ridgewood, N. J.
Howard, Martin Stoddard Northfield, Vt.
Hunt, Kenneth Whitten Springfield.
Jensen, Henry Wilhelm Boston.
Jones, Fred William Otis.
Joy, John Leo William Amherst.
Kinney, Asa Foster South Hadley.

Labarge, Robert Rolland Holyoke.
Lawlor, John Thomas, Jr. Marblehead.
Loud, Miriam Johnson Plainfield.
Lynds, Lewis Malcolm Taunton.
MacCausland, Mabel Alice West Newton.
Madden, Archie Hugh Amherst.
Magnuson, Herman Rainville Manchester.
Mann, Raymond Simmons Dalton.
Manwell, Flora Eleanor Williamsburg.
Marcus, Theodore Roxbury.
Maylott, Gertrude Worcester.
McKay, Catherine Mary Newtonville.
Morgan, Isabel Elvira Schenectady, N. Y.
Morse, Beryl Florence Southbridge.
Murphy, Donald Fraser Lynn.
Nickerson, Ralph Francis Attleboro.
Nims, Russell Everett Greenfield.
O'Leary, William Joseph Northampton.
Packsarian, John Paul Franklin.
Phinney, William Roland Willimansett.
Pillsbury, William Gale Amesbury.
Pollin, Ida Edith Springfield.
Pottala, Arne Eric Fitchburg.
Purdy, Wilfred George Amherst.
Pyle, Arthur Guard Plymouth.
Riley, Vincent Joseph Somerset.
Robertson, Harold Leyden.
Ronka, Lauri Samuel Gloucester.
Rudman, Paul Arthur Agawam.
Rutan, Huntington North Hadley.
Sandstrom, Evelyn Cecelia Auburn.
Saraceni, Raphael Lynn.
Sederquist, Arthur Butman, Jr. Peabody.
Singleton, Eric Brooklyn, N. Y.
Smith, Raymond Francis Needham.
Smith, Winthrop Grant Needham Heights.
Spooner, Laurence Whipple Brimfield.
Stacy, Paul West Yarmouth.
Stanford, Spencer Clarendon Rowe.
Stiles, Alice Goodrich Westfield.
Stone, Ruth Winifred Holyoke.
Suher, Maurice Holyoke.
Sullivan, William Nicholas, Jr. Lawrence.
Swift, Gilbert Dean Melrose.
Taft, Jesse Alderman Mendon.
Taft, Roger Sherman Sterling.
Tank, John Richard Chatham, N. Y.
Thatcher, Christine Belle Cummington.
Tomfohrde, Karl Martin West Somerville.
Vaughan, Herbert Sidney Attleboro.
Wadleigh, Cecil Herbert Milford.
Waechter, Peter Hansen, Jr. Walpole.
White, Frank Tisdale, Jr. Holbrook.
White, Harold James Brighton.
Wood, Priscilla Grover West Bridgewater.
Woodin, Elizabeth Marie Adams.
Zuger, Albert Peter New Haven, Conn.

Bachelor of Vocational Agriculture (B. Voc. Agri.)

McIsaac, Donald Weston East Weymouth.
Skogsberg, Frank Albert Worcester.

REGISTRATION, 1930-31.

Graduate Students.

Superior figures indicate: [1] Enrolled during academic year 1929–30.
[2] Enrolled in Summer School 1930.
[3] Enrolled during academic year 1930–31.

Albrecht, Ira W.[1 2 3] Chemistry. Agl. Education Westfield.
B.S., Columbia University.
Albro, Gardner M.[1] Chemistry. Math. and Physics Newport, R. I.
B.S., Rhode Island State College.
Allen, Thomas [2] Belchertown.
A.B., Colgate University.
Batson, Ferris S.[1] Landscape Architecture Perkinston, Miss.
B.S., Mississippi A. & M. College.
Beeman, Marjorie E.[1 3] Agl. Education. Bact. and Zoology . . . Ware.
B.S., Massachusetts Agricultural College.
Bell, Ellsworth W.[1] Amherst.
B.S., Pennsylvania State College.
M.S., University of Vermont.
Bennett, Emmett [3] Blanchester, Ohio.
B.S., Ohio State University.
Bergan, Carl A.[1] Agl. Education Northampton.
B.S., Massachusetts Agricultural College.

Bittinger, Richard.[1 2] Agl. Education Springfield.
B.S., Massachusetts Agricultural College.
Boisvert, Oscar.[1 2 3] Dairy Industry. Bacteriology Lyster Station, Megantic Co., P. Q.
B.A.S., Laval University.
Bovarnick, Max.[1 3] Agl. Economics Mattapan.
B.S., Massachusetts Agricultural College.
Bourgeois, Florence [3] Williamsburg.
B.A., Smith College.
Bower, James, Jr.[2] Agl. Education. Science Holyoke.
B.S., Massachusetts Agricultural College.
Brady, Anna [2] New Bedford.
B.S.E., Bridgewater Normal School.
Brennan, Grace C.[1 2] Holyoke.
A.B., Mt. Holyoke College.
Briggs, Lawrence E.[1 3] Rockland.
B.S., Massachusetts Agricultural College.
Brown, Kenneth T.[3] Landscape Architecture Mexico, Me.
B.S., University of Maine.
Brown, Lorimer H.[2] Northampton.
B.S., Middlebury College.
Bullis, Kenneth L.[3] De Kalb, Ill.
D.V.M., Iowa State College.
Burke, Edward J.[2] Agl. Education Hatfield.
B.S., Massachusetts Agricultural College.
Carlson, Oscar E.[2] Amherst.
B.S., Massachusetts Agricultural College.
Canis, Robert P.[3] Botany. Chemistry. Ozone Park, Long Island, N. Y.
B.S., M.S., Rutgers University.
Carpenter, David F.[1] Agl. Education. Science Millers Falls.
B.S., Massachusetts Agricultural College.
Chadwick, John S.[3] Landscape Architecture Worcester.
B.S., Massachusetts Agricultural College.
Clague, John A.[1 3] Horticulture. Bact. and Physiology Tacoma, Wash.
B.S., University of Washington.
Clark, Emerson S.[2] Agl. Education Guilford, Conn.
B.S., Connecticut Agricultural College.
Clark, Hermon R.[1] Agl. Education. Engineering and Rur. Soc. . . Springfield.
B.S., University of Maine.
Cleveland, Maurice M.[3] Chemistry. Hort. Man. and Bacteriology . . East Pepperell.
B.S., Massachusetts Agricultural College.
Cook, Albert C.[1] Agl. Education Wilbraham.
B.S., Massachusetts Agricultural College.
Cooke, Helen B.[2] Agl. Education Richmond.
B.S., Rutgers University.
Cormier, Mrs. Mary T.[2] Ludlow.
B.S.E., Salem Normal School.
Coven, Milton.[2] Agl. Economics. Agl. Education Springfield.
B.S., Massachusetts Agricultural College.
Cowing, William A.[1 3] Agl. Education. Science West Springfield.
A.B., Colby College.
Cowing, Ulmont C.[2] Agl. Education West Springfield.
B.S., Colby College.
Crooks, G. Chapman.[1] Chemistry. Bacteriology and Physiology . . North Brookfield.
A.B., Amherst College.
Currie, Eugene K.[2] Agl. Education Ashfield.
A.B., Colby College.
DeVault, Samuel H.[1] Agl. Economics. Rur. Soc. and Agl. Education . College Park, Md.
A.B., Carson-Newman College.
A.M., University of North Carolina.
Dickinson, Lawrence S.[1 3] Horticulture Amherst.
B.S., Massachusetts Agricultural College.
Farrar, Clayton L.[1 2 3] Entomology. Botany. Chemistry . . . Amherst.
B.S., Kansas State Agricultural College.
Foley, Richard C.[1 2 3] Agronomy. Animal Husbandry Portland, Me.
B.S., Massachusetts Agricultural College.
Forman, Kenneth W.[2] Agl. Education. Animal Husbandry . . . Danvers.
B.S.A., University of Toronto.
France, Ralph L.[3] Amherst.
B.S., University of Delaware.
M.S., Massachusetts Agricultural College.
Gallant, James F.[2] Agl. Education Worcester.
B.S., Connecticut Agricultural College.
Gates, Clifford O.[1] Landscape Architecture Kokoma, Ind.
B.S.A., Purdue University.
Germany, Claude B.[3] Agl. Education Athol.
A.B., Harvard College.
Gleason, Edward K.[3] Agl. Education. Math. and Physics . . . Shrewsbury.
B.S., New York State College of Forestry, Syracuse University.
Goodwin, William I.[1] Agl. Economics North Amherst.
B.S., Massachusetts Agricultural College.
Gorman, Katherine L.[2] Agl. Education Holyoke.
B.S., Simmons College.
Griffiths, Francis P.[1] Chemistry. Hort. and Microbiology . . . Seattle, Wash.
B.S., University of Washington.
Haddock, Jay L.[3] Agronomy. Chemistry Bloomington, Idaho.
B.S., Brigham Young University.
Harlow, John M.[3] Landscape Architecture Duluth, Minn.
A.B., Dartmouth College.
Hatch, Herbert T.[3] South Hanover.
B.S., Massachusetts Agricultural College.
Hoffman, Erich [3] Halle, Germany.
D.Sc., University of Halle.

Holway, Alfred H.[3] Agl. Education. Math. and Physics . . . Holyoke.
B.S., Massachusetts Agricultural College.
Hopkins, Alden.[1] Landscape Architecture Chepachet, R. I.
B.S., Rhode Island State College.
Horne, Thomas R.[1 3] Landscape Architecture Abbeville, Ala.
B.S., Alabama Polytechnic Institute.
Horsley, Ernest M.[3] Dairy Industry. Bact. and Chemistry . . . Brigham City, Utah.
B.S., Utah State Agricultural College.
Howard, Lucius A.[3] Landscape Architecture Ridgewood, N. J.
B.S., Massachusetts Agricultural College.
Howard, Martin S.[3] Landscape Architecture Northfield, Vt.
B.S., Massachusetts Agricultural College.
Hutchings, Frank F.[1] Agl. Education. Science New Bedford.
B.S., Massachusetts Agricultural College.
Johnson, Edward D.[1] Landscape Architecture Monmouth, Me.
B.S., University of Maine.
Jones, Fred W.[3] Chemistry. Physics Otis.
Massachusetts Agricultural College.
Jones, William L.[3] Agronomy. Botany Bryan, Tex.
B.S., M.S., Texas A. & M. College.
Julian, Arthur N.[2] Chemistry. Microbiology Amherst.
B.A., Northwestern University.
Kelly, Oliver W.[1] Agronomy. Botany Amherst.
B.S., Colorado Agricultural College.
M.S., Massachusetts Agricultural College.
Knudsen, Harold R.[1] Agronomy. Chemistry Amherst.
B.S., Brigham Young University.
Labarge, Robert R.[3] Agl. Education. Chemistry Holyoke.
B.S., Massachusetts Agricultural College.
Lacroix, Don S.[1] Amherst.
B.S., M.S., Massachusetts Agricultural College.
Ladas, Constantine P.[1] Agl. Education. Rural Sociology . . . Boston.
B.S., Massachusetts Agricultural College.
Landry, Herbert A.[1 3] Agl. Education. Microbiology. West Springfield.
B.M.E., Northeastern University.
Larsinos, George J.[1] Agronomy. Chemistry Amherst.
B.S., M.S., Massachusetts Agricultural College.
Leivo, Thure M.[1] Landscape Architecture New Castle, Pa.
B.Arch., Carnegie Institute Technology.
Lippincott, Stuart W.[1] Microbiology. Chemistry Worcester.
A.B., Clark College.
Lowry, Wayne J.[1 3] Horticulture. Landscape Architecture . . . Midland, Mich.
B.S., Michigan State College.
Lynch, Elizabeth A.[1 2 3] Agl. Education. Landscape Architecture . . Easthampton.
B.S., Massachusetts Agricultural College.
Mackimmie, Alexander A., Jr.[1] Agl. Education. Rural Sociology . . North Amherst.
B.A., Amherst College.
Magnuson, Herman R.[3] Landscape Architecture Manchester.
B.S., Massachusetts Agricultural College.
McDonnell, Charles P.[1 2 3] Agl. Education West Springfield.
A.B., Catholic University.
Merritt, Lucius A.[3] Agl. Education. Science Williamsburg.
B.S. Trinity College.
Moore, Caroll P.[1] Agl. Education Somers, Conn.
B.S., Connecticut Agricultural College.
Moriarty, Helen E.[2 3] Botany Holyoke.
A.B., Smith College.
Morse, Miriam.[1] Entomology. Zoology and Botany New Braintree.
B.S., St. Lawrence University.
Mulford, William.[3] Landscape Architecture Northampton.
A.B., Harvard College.
Newton, Richard C.[1] Entomology. Zoology and Botany . . . Middletown, Conn.
B.S., Connecticut Agricultural College.
Nickerson, Ralph F.[3] Chemistry. Physics Attleboro.
B.S., Massachusetts Agricultural College.
Nicolaides, Costas.[3] Poultry Science Waterbury, Conn.
B.S., Rutgers University.
Oberempt, Gertrude [2] Easthampton.
Ph.B., Brown University.
O'Malley, Michael J.[3] Agl. Education. Science West Springfield.
B.S., University of New Hampshire.
Packard, Faith E.[1] Crown Point, N. Y.
B.S., Massachusetts Agricultural College.
Packard, Ransom C.[3] Bacteriology. Chemistry North Amherst.
B.S.A., University of Toronto.
Parrott, Ernest M.[3] North Amherst.
B.S., Union University.
Parsons, Clarence H.[1 2 3] An. Husbandry. Agronomy . . . North Amherst.
B.S., Massachusetts Agricultural College.
Phinney, William R.[2 3] Agl. Education Amherst.
B.S., Massachusetts Agricultural College.
Plantinga, Oliver S.[1] Chemistry. Math. and Physics Amherst.
B.S., Massachusetts Agricultural College.
Plantinga, Sarah T.[1 2] Agl. Education. Chemistry Amherst.
B.S., Massachusetts Agricultural College.
Pray, Francis C.[3] Agl. Education Amherst.
B.S., Massachusetts Agricultural College.
Putnam, Ernest T.[2] Greenfield.
B.S., Massachusetts Agricultural College.
Rea, Julian S.[3] Inhambane, Portuguese East Africa.
B.S., Massachusetts Agricultural College.

Redmon, Bryan C.[3] Chemistry Paris, Ky.
B.S., University of Kentucky.
Rice, Cecil C.[1 3] Horticulture Worcester.
B.S., Massachusetts Agricultural College.
Rice, Victor A.[2] An. Husbandry. Zoology Amherst.
B.S., North Carolina State College.
M.Ag., Massachusetts Agricultural College.
Richmond, E. Avery.[1] Entomology. Botany. Zoo. and Chemistry . Riverton, N. J.
B.S., Dartmouth College.
M.A., Cornell University.
Rohde, Gustav [1] Halle, Germany.
D.Sc., Halle University.
Salman, Kenneth A.[1] Entomology. Chemistry. Botany and Zoology . Amherst.
B.S., Massachusetts Agricultural College.
Shepard, Harold H.[1] Entomology. Zoology. Chemistry . . . Takoma Park, Md.
B.S., Massachusetts Agricultural College.
M.S., University of Maryland.
Smart, Harold W.[3] Rural Sociology. Agl. Education Amherst.
LL.B., Boston University.
A.B., Amherst College.
Smith, Walter R.[1] Chemistry. Math. and Physics Holden.
B.S., Massachusetts Agricultural College.
Spaulding, Ruth [2] Amherst.
A.B., Middlebury College.
Stewart, Sarah E.[1] Bacteriology. Chemistry Las Cruces, New Mexico.
B.S., New Mexico Agricultural College.
Stiles, Alice G.[3] Bacteriology and Physiology. Chemistry . . Westfield.
B.S., Massachusetts Agricultural College.
Stitt, Rhea E.[1] Agronomy. Botany Huron, So. Dak.
B.S., South Dakota State College.
Strickland, John A.[3] Poultry Science Byhalia, Miss.
A.B., Rust College.
Stuart, William M.[3] Agronomy. Chemistry. Botany Washington, Va.
B.S., Virginia Polytechnic Institute.
Sullivan, John A.[1] Agl. Education. Vet. Science and Botany . . Medford.
B.S., Massachusetts Agricultural College.
Sullivan, William N., Jr.[3] Entomology. Botany Lawrence.
B.S., Massachusetts Agricultural College.
Sweetman, Harvey L.[1] Entomology. Zoology. Botany . . . Las Animas, Colo.
B.S., Colorado Agricultural College.
M.S., Iowa State College.
Taft, Jesse A.[2] Horticulture. Agl. Education Mendon.
B.S., Massachusetts Agricultural College.
Tague, Mrs. Ada W.[3] North Amherst.
B.S., Iowa State College.
Thatcher, Christine B.[3] Agl. Education Cummington.
B.S., Massachusetts Agricultural College.
Thelin, Guy.[3] Agronomy. Botany Sioux Falls, So. Dak.
B.S., South Dakota State College.
Van Arendonk, Arthur M.[3] Chemistry Wallkill, N.Y.
A.B., Hope College.
Van Meter, Ralph A.[1 2] Pomology. Agl. Education. Mathematics . North Amherst.
B.S., Ohio State University.
Van Veghten, Grant B.[3] Botany. Chemistry Rochester, N.Y.
B.S., New York State College of Agriculture, Cornell University.
Weeks, Mildred A.[3] Agl. Education South Gardner.
A.B., Radcliffe College.
White, Harold J.[3] Bacteriology. Chemistry Brighton.
B.S., Massachusetts Agricultural College.
Williams, Inez W.[3] Entomology. Botany Brockton.
B.S., Massachusetts Agricultural College.
Williams, Forrest E.[2 3] Agl. Education Agawam.
B.S., Massachusetts Agricultural College.
Williams, Mrs. Ruth B.[2] Agawam.
A.B., Smith College.
Wright, David S.[2] Agl. Education Northampton.
A.B., Amherst College.

SUMMARY GRADUATE STUDENTS.

	Men.	Women.	Total.
Enrolled during academic year 1929–30 . .	51	7	58
Enrolled in Summer School, 1930 . . .	26	11	37
Enrolled during academic year 1930–31 . .	56	9	65
Total excluding duplications . . .	108	21	129

UNDERGRADUATE STUDENTS.

CLASS OF 1931.

Barry, Elizabeth Evans Lynn Abigail Adams House.
Bartlett, Leonard, Jr. East Walpole . . . Lambda Chi Alpha.
Bartsch, Nelson Edgar Belmont Phi Sigma Kappa.
Beaman, Evelyn Armstrong . . . Leverett Abigail Adams House.
Bonney, Walter Twichell . . . Springfield . . . Kappa Epsilon.
Bosworth, William Ezra, Jr. . . . Holyoke President's House.
Bottomly, Bruce Ely Worcester . . . 84 Pleasant Street.
Bradley, Sally Elizabeth . . . Lee Abigail Adams House.

Brooks, James Hapgood, 3d	Worcester	46 Pleasant Street.
Brown, Alfred Alexander	Methuen	Phi Sigma Kappa.
Buck, Wilbur Francis	Stockbridge	Lambda Chi Alpha.
Burnham, Catharine Annette	Shelburne	Care of Mr. Oleson, North Amherst.
Burnham, John[1]	Shelburne Falls	Baker Lane.
Cahoon, Mildred Adeline	Centerville	Abigail Adams House.
Calvi, John	Athol	Colonial Inn.
Campbell, Jocelyn Ann	Springfield	The Homestead.
Carpenter, Henry Dunphe	Bridgewater	Q. T. V.
Chadwick, Alan William	Worcester	Lambda Chi Alpha.
Chenoweth, Winifred Lee	North Amherst	North Amherst.
Clarkson, Marjorie	Worcester	Abigail Adams House.
Costello, John Paul	Franklin	Q. T. V.
Cucinotta, Lewis Bohlin	Camden, Me.	Alpha Sigma Phi.
Dangelmayer, Wynton Reid	Waltham	Lambda Chi Alpha.
Daniels, Arthur Richards	Dedham	Q. T. V.
Darling, Herbert Daniel	Brighton	Lambda Chi Alpha.
Davis, George Merrill	South Lee	Kappa Sigma.
Davis, Richard William	Melrose	Phi Sigma Kappa.
DeFalco, Iris Norma	North Adams	Abigail Adams House.
Digney, Anna Katherine	Boston	The Homestead.
Douglass, Frank Taylor	Springfield	Alpha Gamma Rho.
Dyer, Cora Gennette	Northampton	Abigail Adams House.
Field, George White	Florence	76 Dana Street.
FitzGerald, Paul Richard	Revere	6 North Prospect Street.
Flood, George Millard	North Adams	83 Pleasant Street.
Fraser, Richard Arthur	Lowell	Alpha Gamma Rho
Frey, Newell William	South Hadley Falls	Kappa Epsilon.
Friedrich, Thelma Selene	Florence	Abigail Adams House.
Frost, Edmund Locke	Arlington	Phi Sigma Kappa.
Gilgut, Constantine Joseph	Athol	Clark Hall.
Goodrich, Raymond Eldred	Amherst	3 South East Street.
Gordon, Jeane	Holyoke	Abigail Adams House.
Gorman, Joseph William	Upton	Phi Sigma Kappa.
Gower, Albert Hugh	Brighton	Kappa Epsilon
Griffith, Janet Anne	Wareham	Abigail Adams House.
Guenard, John Robert	Dracut	17 Phillips Street.
Gula, Joseph John	Bondsville	3 Fearing Street.
Hacker, Walter Breed	Natick	6 Phillips Street.
Hanks, Harry Mason, Jr.	Nantucket Island	Phi Sigma Kappa.
Hanslick, Otis Henry	Somerville	Amherst Tavern.
Hastings, Emory Barton	Athol	4 Chestnut Street.
Hayes, Ernest Littlefield	Milton	Q. T. V.
Hines, Francis Martin	Arlington	Alpha Gamma Rho.
Holm, Carl Gustaf[1]	Worcester	Alpha Gamma Rho.
Johnson, Arthur Clement Marriott	Greenfield	Lambda Chi Alpha.
Johnson, Erik Alfred	Springfield	Alpha Gamma Rho.
Jones, Lawrence Arthur	Greenfield	Lambda Chi Alpha.
Kimball, Philip Wadsworth	Northboro	Phi Sigma Kappa.
King, Marc Nesmith	Waltham	Lambda Chi Alpha.
Kneeland, Ralph Folger, Jr.	Attleboro	Alpha Sigma Phi.
Koerber, Margaret Eleanore	Northampton	The Homestead.
Lamb, Francis Bleakie	White Plains, N. Y.	Phi Sigma Kappa.
Lawrence, John Cheney	Brimfield	Alpha Sigma Phi.
LeClair, Gertrude Leah	Southbridge	Abigail Adams House.
Little, Charles Lunt	West Medford	Kappa Sigma.
Loar, Russell Dudley	Longmeadow	84 Pleasant Street.
Lorrey, Robert Henry	Watertown	Lambda Chi Alpha.
Lyman, Evelyn May	East Longmeadow	Abigail Adams House.
Manty, Charles Weikko	Maynard	Lambda Chi Alpha.
Marshall, Mary Moore	Whitinsville	Abigail Adams House.
Mason, Frank Ford, Jr.	Williamstown	West Experiment Station.
McGuckian, John William	Roslindale	Q. T. V.
McKeen, Richard Potter	Watertown	Q. T. V.
Mead, Gertrude Alice	Townsend	Abigail Adams House.
Meyer, Beatrice Florentine	Amherst	Abigail Adams House.
Monk, Marjorie	Longmeadow	The Homestead.
Myrick, Norman	Longmeadow	Lambda Chi Alpha.
Nash, Clyde Woodbury	Haverhill	83 Pleasant Street.
Nason, David Mitchell	Medford	Kappa Sigma.
Norell, Frieda Brita	Amherst	Abigail Adams House.
Northcott, John Warren, Jr.	New Bedford	Alpha Gamma Rho.
Oliver, George West	Watertown	Phi Sigma Kappa.
Pierce, Gertrude Keith	Shelburne Falls	Abigail Adams House.
Plantinga, Martin Peter	Amherst	18 North East Street.
Pyenson, Louis	East Lee	Delta Phi Alpha.
Reuter, Anna-May	Northfield	Draper Hall.
Rooney, Robert Colbert	Reading	Lambda Chi Alpha.
Rubin, Theodore	Brooklyn, N.Y.	Delta Phi Alpha.
Russell, Grace Shirley	Easthampton	Abigail Adams House.
Scott, Ruth Elizabeth	North Hadley	Abigail Adams House.
Shaw, Frank Robert	Belchertown	Belchertown.
Smith, Ernest Gordon	Medford	Phi Sigma Kappa.
Smith, Paul Augustus	Malden	Phi Sigma Kappa.
Somes, John	Otis	West Experiment Station.
Spiewak, Pauline Anna	Holyoke	Abigail Adams House.
Stanisiewski, Leon	Amherst	Triangle Street.

[1] Candidate for Degree of Bachelor of Vocational Agriculture.

Stevenson, Errol Burton	Brockton	Stockbridge Hall.
Stoddard, Herbert Tilden	Cohasset	Inwood.
Stuart, Robert Emerson	Littleton	66 Lincoln Avenue.
Takahashi, Leopold Hanzo	Amherst	37 Whitney Street.
Tashjian, Souren Markar	Amherst	6 Phillips Street.
Tiffany, Don Cecil	Cambridge	15 Fearing Street.
Troy, Frederick Sherman	Arlington	4 Baker Lane.
Tucker, Robert Barclay	Middleboro	Kappa Sigma.
Upton, Shirley	North Reading	The Homestead.
Vichules, Marguerite Veronica	Northampton	7 Maple St., Northampton.
Vincent, Lionel Lewis	Westminster	M. A. C. Farmhouse.
Wahlgren, Hardy Lewis	Melrose	Lambda Chi Alpha.
West, Allen Sherman, Jr.	Springfield	Kappa Sigma.
Westendarp, Edwin Maurice	Saugus	Phi Sigma Kappa.
White, Edwin Theron	Millbury	Alpha Gamma Rho.
Whittum, Frederick Kinsley	Springfield	Kappa Sigma.
Woods, James Joseph, Jr.	Leominster	28 Pleasant Street.
Wright, Denise	Amherst	109 Butterfield Terrace.
Yeatman, Alwyn Frederick	Springfield	26 Fearing Street.

CLASS OF 1932.

Anderson, Carrolle Elizabeth	Ashfield	Ashfield.
Batstone, William Frank	West Newton	Theta Chi.
Black, Mary Egesta	Williamsburg	8 Allen Street.
Boland, Katherine	Dracut	Abigail Adams House.
Boston, Margaret Mary	Auburndale	Abigail Adams House.
Bunten, John Frederick	Brockton	Kappa Sigma.
Burrington, John Cecil, Jr.	Charlemont	Phi Sigma Kappa.
Caird, Wynne Eleanor	Dalton	Abigail Adams House.
Carter, Forrest Edward	Wakefield	R. F. D. Route 3, Box 77
Chapman, Kenneth William	Springfield	Lambda Chi Alpha.
Chase, Herbert Manton, Jr.	Newport, R. I.	Kappa Sigma.
Cheney, Howard Alton	Springfield	Kappa Sigma.
Church, Gertrude Barber	North Amherst	North Amherst.
Clark, Webster Kimball, Jr.	West Deerfield	Q. T. V.
Cohen, William	Springfield	Care of H. R. DeRose, Farview Way.
Cone, John Paine	Amherst	34 Amity Street.
Connell, Philip Joseph	Springfield	Sigma Phi Epsilon.
Cooley, Laura Grace	Sunderland	"Plumtrees," Sunderland
Davis, William Proud	Waltham	Lambda Chi Alpha.
DeGelleke, Peter	Troy Hills, N. J.	15 Phillips Street.
Delisle, Albert Lorenzo	South Hadley Falls	453 Newton Street, South Hadley Falls.
Dickinson, Thelma Louise	Greenwich	Abigail Adams House.
Diggs, Robert Lewis	Brighton	Q. T. V.
Doerpholz, Eunice Minerva	Holyoke	30 Glen Street, Holyoke.
Donaghy, Edward Joseph	New Bedford	Box 36, North Amherst.
Doyle, James Edward	Northampton	Kappa Epsilon.
Edmond, Stuart Deane	Amherst	8 South Prospect Street.
Evans, Richard Warren	North Attleboro	Lambda Chi Alpha.
Fabyan, Warren White[1]	South Weymouth	Q. T. V.
Fiore, Celeste	Montclair, N. J.	Abigail Adams House.
Fisher, William Sidney, Jr.	Amherst	13 South College.
Fletcher, Robert Bliss	Worcester	Theta Chi.
Foley, John Joseph	Amherst	Kappa Sigma.
Folger, Richard Sloane	Roslindale	Kappa Sigma.
Fontaine, Arthur Lewis	Allston	Sigma Phi Epsilon.
Forest, Herbert Leon	Arlington	Colonial Inn.
Foskett, Clifford Robert[1]	East Weymouth	Q. T. V.
Gagliarducci, Vincent Nicholas	Springfield	Kappa Epsilon.
Goodall, Leslie Duncan	Winthrop	Kappa Sigma.
Goodwin, Azor Orne	Marblehead	Kappa Epsilon.
Gordon, Laura Elizabeth	Ipswich	Abigail Adams House.
Greene, William Capewell	Middlebury, Conn.	Kappa Sigma.
Gunness, Robert Charles	Amherst	105 Butterfield Terrace.
Hale, Kenneth Fowler	Tolland	Sigma Phi Epsilon.
Haynes, Arnold Calvin	Springfield	Phi Sigma Kappa.
Hickney, Zoe Edwina	Auburn	15 Sunset Avenue.
Hitchcock, John David	West Medway	42 Lincoln Avenue.
Holder, Eben Daniel	Hudson	Q. T. V.
Holmberg, Oscar Edward	Waltham	Lambda Chi Alpha.
Holz, Henry	North Andover	Alpha Gamma Rho.
Howe, Elizabeth Vose	South Acton	Abigail Adams House.
Howe, Evan Carlton	Norfolk	Theta Chi.
Howlett, Carey Harris	Southampton	Hatch Barn, M. A. C.
Hunter, Marion Brockway	Holyoke	Abigail Adams House.
Johnson, Catharine Genevieve	Amherst	Eames Avenue.
Johnson, William Anders	Haverhill	Theta Chi.
Jorczak, Joseph Stanley	Chicopee	Q. T. V.
Kaylor, John Daniel	Fall River	Sigma Phi Epsilon
Keyes, Curtis Gilbert	Whitinsville	French Hall, M. A. C.
Killeen, John Bernard, Jr.	Cambridge	81 Pleasant Street.
Lake, Susan Glidden	Avon	8 Lessey Street.
Lawrence, Edwina Frances	Springfield	Abigail Adams House.
Lepie, Joseph Edward	Dorchester	Delta Phi Alpha.
Levine, Harry	Springfield	19 Pleasant Street.
Libbey, William Clinton	Westboro	The Apiary.
Loomer, Edward Alfred	Abington	Kappa Sigma.

[1] Candidate for Degree of Bachelor of Vocational Agriculture.

MacLean, John Douglas	West Bridgewater	Stockbridge Hall, M. A. C.
Mamaqui, Nusret Osman	Lynn	Alpha Gamma Rho.
Margolin, Oscar	Newtonville	7 Phillips Street.
Markus, Christine Veronica	Monson	Abigail Adams House.
Mason, Donald Mowatt	South Easton	Kappa Sigma.
Merritt, Orris Elma	Sheffield	Abigail Adams House.
Merritt, Richard Hyde	Williamsburg	44 Triangle Street.
Miller, Frank Edward, Jr.	Lynn	Mathematics Building, M. A. C.
Mitchell, Ernest Wilson, Jr.	Newburyport	Kappa Sigma.
Mitchell, Robert Dawson	Holyoke	Alpha Sigma Phi.
Morrison, Florence Lee	Williamstown	Abigail Adams House.
Nelson, Harmon Oscar, Jr.	Whitinsville	Phi Sigma Kappa.
Nourse, Arthur Lesure	Westboro	83 Pleasant Street.
O'Donnell, Patrick Edward	North Abington	86 Pleasant Street.
Ohlwiler, Margaret	Southbridge	Abigail Adams House.
Parsons, Anna Thankful	Southampton	Abigail Adams House.
Pineo, Victor Clifton	Hadley	Hadley.
Pollard, Robert Lonsdale	Amherst	84 Pleasant Street.
Pollin, Lillian Pauline	Springfield	33 Lincoln Avenue.
Potter, Rial Strickland, Jr.	Springfield	Sigma Phi Epsilon.
Powers, John Joseph	Framingham	30 Fearing Street.
Prince, Carlton Gordon	Adams	10 Nutting Avenue.
Raplus, Harry Edward	East Longmeadow	Kappa Epsilon.
Reed, Elizabeth Ruth	Dalton	Abigail Adams House.
Rice, Clara Ruth	Charlemont	Farview Way.
Roffey, Robert Cameron	Rockport	Alpha Sigma Phi.
Ross, Paul Howard	Waltham	Theta Chi.
Runvik, Kenneth Carl	Worcester	Kappa Epsilon.
Ryan, John Bartlett, Jr.	Swampscott	Alpha Sigma Phi.
Salenius, Charles Henry	Hingham	97 Pleasant Street.
Salisbury, Alston Moore	Melrose Highlands	Alpha Gamma Rho.
Salter, Leonard Austin, Jr.	Springfield	Lambda Chi Alpha.
Smith, Aleck	Everett	Delta Phi Alpha.
Smith, George Gilman	Lebanon, N. H.	Alpha Gamma Rho.
Springer, Frank Leslie	Arlington	Alpha Gamma Rho.
Stuart, Wallace Wyman	Littleton Common	66 Lincoln Avenue.
Sylvester, George Stull	Glen Rock, N. J.	Phi Sigma Kappa.
Taylor, Avis Ruth	Dedham	Abigail Adams House.
Taylor, Clarisse Marie	Lee	Abigail Adams House.
Tetro, Robert Carl	Williamsburg	Alpha Gamma Rho.
Thompson, Elmer Joseph	Brookline	Kappa Sigma.
Tikofski, John William	Walpole	Colonial Inn.
Tippo, Oswald	Jamaica Plain	Box 36, North Amherst, Care of Mrs. Shampo.
Towle, Gifford Hoag	Holden	Box 132, M. A. C.
Twiss, Mildred Florence	Hudson	Abigail Adams House.
Utley, Walter Sampson	Chesterfield	35 Lincoln Avenue.
Van Leer, Hans Lodewijk	Hilversum, Holland	Sigma Phi Epsilon.
Voorneveld, William, Jr.	Nantucket	Kappa Sigma.
Warner, Lulu Harriet	Amherst	Shays Street.
Waskiewicz, Edward Julian	Three Rivers	3 Fearing Street.
Watson, Edward Winslow	Plymouth	Phi Sigma Kappa.
Wear, William Homer	Waltham	Lambda Chi Alpha.
Webb, Pauline Alice	Lithia	Abigail Adams House.
Wendell, Charles Butler, Jr.	Belmont	Phi Sigma Kappa.
Wetterlow, Eric Hilding, Jr.	Manchester	Phi Sigma Kappa.
Wheeler, Kenneth Monroe	Great Barrington	Stockbridge Hall, M. A. C.
Wherity, Richard White	Scituate	Alpha Sigma Phi.
Whitten, Gilbert Yould	Melrose	Lambda Chi Alpha.
Wilson, James Louis	Ashland	Phi Sigma Kappa.

Class of 1933.

Adams, Lucile Elizabeth	East Lee	Abigail Adams House.
Ahlstrom, Clifton Nils	Quincy	94 Pleasant Street.
Aldrich, George Elliott	Northampton	Pine Street, North Amherst.
Anderson, Alice Gunhild	Everett	Abigail Adams House.
Anderson, Mabelle Lydia	Southwick	13 Fearing Street.
Armstrong, Irene Elizabeth	East Sandwich	Abigail Adams House.
Asquith, Dean	Lowell	Theta Chi.
Astore, John Joseph	West Stockbridge	Kappa Epsilon.
Barnes, Gertrude Agnes	Richmond	Abigail Adams House.
Barr, John Butler	Lowell	81 Pleasant Street.
Barter, John Chaffer	Shrewsbury	66 Pleasant Street.
Bearse, Arthur Everett	Sharon	81 Pleasant Street.
Bedord, Wilfred Hugh	Monson	27 Fearing Street.
Beeler, Nelson Frederick	Adams	Phi Sigma Kappa.
Beeman, Evelyn Elizabeth	Ware	Abigail Adams House.
Bell, Burton Brainard	Addison, Conn.	31 North Prospect Street.
Benjamin, Doris Beulah	Ashfield	33 Lincoln Avenue.
Best, Dorothy Gertrude	Holyoke	Abigail Adams House.
Bickford, Ralph Henry	Cheshire	8 Nutting Avenue.
Billings, Reginald Winslow	Plainfield	27 Fearing Street.
Bishop, Herbert Lorimer, Jr.	Worcester	30 Fearing Street.
Bowler, Gerald Thomas	Westfield	Q. T. V.
Brackett, Muriel Viola	Marblehead	Abigail Adams House.
Brown, Arthur Endicott	Wayland	Phi Sigma Kappa.
Brown, Chester Cromwell	Wayland	Phi Sigma Kappa.
Bulman, James Cornelius	Greenfield	Alpha Sigma Phi.
Cain, George Herbert	Braintree	Alpha Gamma Rho.
Caragianis, Costas Louis	Dracut	Sigma Phi Epsilon.

Cary, Marjorie Elizabeth	Lyonsville	Abigail Adams House.
Chenoweth, Howard Whitten	North Amherst	North Amherst.
Clancy, Carl Francis	Dedham	8 Nutting Avenue.
Clark, Charles Edward	Bedford	Q. T. V.
Clark, Newell Lloyd	Springfield	14 Kellogg Avenue.
Cossar, Hollis Ford	North Sudbury	18 Nutting Avenue.
Crowell, John Brewer	Boonton, N. J.	15 Phillips Street.
Cummings, Benton Pierce	Ware	Sigma Phi Epsilon.
Dechter, Joseph Maxwell	Chelsea.	Delta Phi Alpha.
Dingman, Stanley Thomas	Palmer	Care of Mrs. Bolter, Cosby Avenue.
Dods, Agnes Miriam	Leverett	Montague.
Dyar, George Wellington	Waltham	Stockbridge Hall, M. A. C.
Eldredge, Josephine	Chatham	Abigail Adams House.
Fawcett, Edward Gilbert	Amherst	70 Lincoln Avenue.
Flavin, Edward Michael	Greenfield	Alpha Sigma Phi.
Flynn, Alice Dorothea	Easthampton	129 Park Street, Easthampton.
Fowler, John Malcolm	West Newton	Kappa Sigma.
Frecheville, Honore Hamilton	London, England	Abigail Adams House.
Gallup, Edward Louis	Norfolk	Theta Chi.
Garity, Agnes Elinor	Boston	Abigail Adams House.
Gerrard, Margaret Lawrence	Holyoke	Abigail Adams House.
Gertz, Max Benjamin	Everett	Delta Phi Alpha.
Gilmore, Samuel Rand	Wrentham	83 Pleasant Street.
Gleason, Cloyes Tilden	Hanover	Kappa Sigma.
Goodell, Bertram Cheney	Southbridge	48 Lincoln Avenue.
Goodstein, William Victor	Everett	Delta Phi Alpha.
Griffin, Katherine Patricia	Holyoke	Abigail Adams House.
Guralnick, Eugene Abraham	Roxbury	Delta Phi Alpha.
Gurney, Ashley Buell	Cummington	10 Nutting Avenue.
Hager, William Perry	South Deerfield	Sigma Phi Epsilon.
Hale, Helen Culvor	South Hadley Falls	44 Bardwell Street, South Hadley Falls.
Hale, Nathan Shirley [1]	Rowley	Alpha Gamma Rho.
Hammond, Richard Clayton	Quincy	Lambda Chi Alpha.
Hanson, Robert	Waltham	18 Nutting Avenue.
Harvey, Edward Winslow	Amherst	Kappa Sigma.
Hodge, Kenneth Elba	Monson	83 Pleasant Street.
Hodsdon, George Edward, Jr.	Gloucester	10 Nutting Avenue.
Hornbaker, Robert Weeks	Worcester	Theta Chi.
Hosford, Robert Stanley	Springfield	84 Pleasant Street.
Houran, Gordon Andrew	Ashburnham	8 Nutting Avenue.
Hovey, Alan Edwin	Ludlow	Kappa Sigma.
Howes, Robert Milton	Swift River	Kappa Epsilon.
Hubbard, Catherine Newton	Sunderland	Abigail Adams House.
Humphreys, Grace Augusta	Amherst	Care of C. A. Peters, Sunset Place.
Isgur, Benjamin	Mattapan	56 Pleasant Street.
Izzi, Emil	South Barre	Kappa Epsilon.
Jahnle, Carl George	Winthrop	Sigma Phi Epsilon.
Johnson, Eunice Moore	Holden	Abigail Adams House.
Kane, Esther Marie	Holyoke	Abigail Adams House.
Karlson, Erick Richard	Worcester	18 Nutting Avenue.
Karlson, Josta Andrew [1]	Worcester	18 Nutting Avenue.
Keenan, John Henry [2]	Dorchester	Box 36, North Amherst.
Klaucke, Elfriede	Worcester	Abigail Adams House.
Kovaleski, John Alexander	Westfield	Q. T. V.
Kulash, Walter Michael	Haydenville	Alpha Gamma Rho.
Leary, Daniel Joseph	Turners Falls	Sigma Phi Epsilon.
LeClair, Charles Alonzo	Amherst	10 Hallock Street.
Levereault, Philip Joseph	Willimansett	Sigma Phi Epsilon.
Maclinn, Walter Arnold	Amesbury	Theta Chi.
Marchelewicz, Joseph Ludwik	Three Rivers	17 Phillips Street.
McCann, Frances Bates	Fall River	Abigail Adams House.
McMahon, Agnes Grimes	Brighton	Abigail Adams House.
Meigs, Walter Hawkins	Westboro	15 Fearing Street.
Meiselman, Harry	Roxbury	Delta Phi Alpha.
Michelson, George	Dorchester	Delta Phi Alpha.
Miller, Charlotte Winifred	South Amherst	South Amherst.
Minarik, Charles Edwin	Westfield	Q. T. V.
Miner, Harold Edson, Jr.	Holyoke	17 Phillips Street.
Moody, Charles William	Pittsfield	27 Fearing Street.
Moody, George Deming	North Andover	57 Lincoln Avenue.
Mucklow, Francis Alfred	Windsor, Conn.	18 Nutting Avenue.
Munson, Janice	Amherst	101 Butterfield Terrace.
Murphy, Sarah Agnes	Dorchester	Abigail Adams House.
Nash, Edmond	Greenfield	Kappa Epsilon.
Nelson, Harold Richmond	Framingham	Kappa Sigma.
O'Mara, Joseph George	South Boston	Box 36, North Amherst.
Ordway, Alfreda Lucie	Hudson	Abigail Adams House.
Parker, Arthur Clough	Lynn	Theta Chi.
Parker, Pearl Gladys	Charlemont	37 Pleasant Street.
Peeso, Marjorie Doris	Belchertown	Belchertown.
Pelissier, Raymond Francis	Hadley	Russell Street, Hadley.
Perkins, Isabel Roberta	Worcester	Abigail Adams House.
Pike, Anita Leigh	Dorchester	Abigail Adams House.
Polar, John	Acushnet	97 Pleasant Street.

[1] Candidate for the Degree of Bachelor of Vocational Agriculture.
[2] Admitted on probation, entrance record incomplete.

Poole, Horace Lincoln	Lynn	French Hall, M. A. C.
Powell, Townsend Henry	Brookfield	Theta Chi.
Prentiss, Doris Ethel	Holyoke	Abigail Adams House.
Pruyne, Granville Sherman	Pittsfield	Kappa Sigma.
Reed, Virginia	Waltham	Abigail Adams House.
Rice, George Comerford	Needham	15 Fearing Street.
Riihimaki, Arthur Alexander	Quincy	15 Phillips Street.
Rosenson, Herbert James	Chelsea	East Experiment Station, M. A. C.
Rowley, Richard Andrew	Holyoke	351 Chestnut Street, Holyoke.
Rudman, Helen Howland	Agawam	Abigail Adams House.
Runge, Paul Martin	Norton	Lambda Chi Alpha.
Russell, Waldo Rufus	Townsend	Lambda Chi Alpha.
Schmid, Alexander August	Brookline	Phi Sigma Kappa.
Scott, Seymour Blois	Sharon	Kappa Sigma.
Semanie, William Michael	Springfield	3 Hallock Street.
Shepard, Sidney	Malden	Delta Phi Alpha.
Shuman, Harold	Greenfield	East Experiment Station, M. A. C.
Sisson, Parker Lincoln	Lynn	13 Phillips Street.
Skelton, Ralph Stearns	Bedford	81 Pleasant Street.
Smith, Robert Lee	Jamaica Plain	56 Pleasant Street.
Smith, William Tyler	North Brookfield	Alpha Gamma Rho.
Snell, Eleanor Lazelle	Worcester	Abigail Adams House.
Sorton, Edgar	Northampton	1 Prospect Court, Northampton.
Soule, Harold Leroy	West Bridgewater	61 Amity Street.
Southwick, Lawrence	Leicester	Theta Chi.
Steffanides, George Fote	Boston	2 Dickinson Street.
Stensby, Leif Edward	Concord	17 Kellogg Avenue.
Stephan, Charles Philip, Jr.	Brooklyn, N. Y.	Kappa Sigma.
Stephansen, Hans Paul	Churchville, Pa.	Kappa Sigma.
Stevens, Doris Hale	Windsor	25 Amity Street.
Stewart, Malcolm Chamberlain	Needham	Kappa Sigma.
Sturtevant, Ralph Francis	Halifax	Kappa Epsilon.
Swartzwelder, John Clyde	East Lynn	15 Fearing Street.
Taft, Robert	Mendon	97 Pleasant Street.
Taylor, Fred Herbert	Groton	Theta Chi.
Taylor, Marion Ruth	Greenfield	Abigail Adams House.
Thompson, Edwin James[1]	Stoughton	61 Amity Street.
Trow, Francis Gilman	Buckland	13 Hallock Street.
Tyler, Stanley Warren	East Lynn	Alpha Sigma Phi.
Vogel, Ruth Marion	Holyoke	70 Lincoln Avenue.
Waite, Harold Vita Montefiore	Northampton	54 Lincoln Avenue.
Walsh, Frank Joseph	Springfield	84 Pleasant Street.
Wanegar, Melvin Harold	Montague City	7½ East Pleasant Street.
Ward, Willard Raymond	Brookline	18 Spring Street.
Warren, Florence Phyllis	Dorchester	19 Phillips Street.
Warren, Philip Wallis	West Auburn	27 Fearing Street.
Welch, Frederick Joseph	Rockland	Alpha Sigma Phi.
Whitcomb, Richard Frank	Springfield, Vt.	Theta Chi.
White, Maurice Francis	Maynard.	Lambda Chi Alpha.
Whitney, Joseph Adolphus	Northampton	61 Fairview Avenue, Northampton.
Wilson, Sylvia Belle	Ware	Abigail Adams House.
Wood, Harold Spencer	Central Village	13 Phillips Street.

CLASS OF 1934.

Adams, Laura Elizabeth	Athol	Abigail Adams House.
Adams, Samuel	Easthampton	16 South College.
Alton, Herbert Roger	Webster	9 North College.
Anderson, Karl Olaf	Boston	Box 36, North Amherst.
Ashley, Muriel Elizabeth	Greenfield	Abigail Adams House.
Baird, Sargent Miller	Summit, N. J.	83 Pleasant Street.
Barrett, Wilmer Dwight	West Bridgewater	1 North College.
Barrus, Thomas Weeks	Lithia	48 North College.
Bartlett, Helen Elnora	Framingham	Abigail Adams House.
Basamania, Stasia Pauline	Holyoke	19 Phillips Street.
Bates, Roger Gordon	Cummington	40 North College.
Batstone, Frank Arthur, Jr.	West Newton	Theta Chi.
Becker, Roland Frederick	Lawrence	31 North Prospect Street.
Bellows, John Morton, Jr.	Maynard	7 South College.
Bennett, Stephen Wiggins[1]	Worcester	10 South College.
Benson, Florence Louise	Worcester	25 Amity Street.
Bernstein, Harry Bernard	Everett	9 South College.
Bick, David Louis	Everett	9 South College.
Bingham, Leonard Joseph	North Andover	18 Nutting Avenue.
Blackburn, Roger Tait	Stoneham	39 North College.
Blanchard, Floyd Orton	Lynn	40 North College.
Bourgeois, George Albert	Williamsburg	Williamsburg.
Bower, William Austin	North Andover	11 South College.
Burke, Raymond Francis	Woronoco	12 South College.
Burr, Franklin Gilmore	Worthington	24 North College.
Bush, Louis Joseph	Turners Falls	Lincoln Avenue.
Cahoon, Kenneth Bangs	Centerville	6 Nutting Avenue.
Caird, David William	Dalton	36 North College.
Call, Calvin Paterson	Colrain	8 South College.
Campbell, Ruth Dexter	Springfield	Abigail Adams House.

[1] Candidate for the Degree of Bachelor of Vocational Agriculture.

Cande, Eleanor Sherman	Sheffield	22 Fearing Street.
Carl, Erma Marie	Holyoke	22 Fearing Street.
Carlin, James Joseph	Hohokus, N. J.	Colonial Inn.
Caswell, Carolyn Marieta	Shattuckville	22 Fearing Street.
Chapin, Norton Spencer	Swampscott	32 North College.
Chase, Donald William	Haverhill	25 North College.
Chase, Greenleaf Tucker	Newburyport	7 North College.
Chesbro, Wallace Lea	Osterville	7 South College.
Churchill, Percival Newton	Elmwood	83 Pleasant Street.
Clark, Frederick Griswold	West Deerfield	15 South College.
Clark, Margaret Lydia	Greenfield	33 Lincoln Avenue.
Clow, Edmund James	Orange	Care of Mrs. Harold Hobart, North Amherst.
Coburn, Joseph Lyman [1]	East Walpole	3 North College.
Cohen, Ralph Sabin	Boston	56 Pleasant Street.
Coldwell, Raymond Dunham	Framingham	4 Hallock Street.
Cole, Kendrick McDowell	Needham	21 North College.
Cole, Randall Knight	West Medway	33 North College.
Coleman, Robert Taylor	Boston	30 North Prospect Street
Cook, Elizabeth Addie	Shrewsbury	Abigail Adams House.
Cook, Frances Lora	Waltham	Abigail Adams House.
Cooke, Theodore Frederic, Jr.	Richmond	1 North College.
Coombs, Charles Edwin	Holyoke	14 North College.
Corcoran, Frederick Leo	Stoneham	15 South College.
Cosgriff, David Edward	Springfield	88 Pleasant Street.
Costa, Flory Gloria	North Agawam	Abigail Adams House.
Cowing, Roy Tapley	West Springfield	10 North College.
Cox, Alfred Elmer	Bridgewater	11 South College.
Crean, Margaret Patricia	Turners Falls	168 Montague City Road, Turners Falls.
Crosby, David	Wakefield	Route 3, R. F. D. 77.
Cummings, Herbert Vincent	Ware	81 Pleasant Street.
Cutler, Richard Thompson	South Sudbury	36 North College.
Cutler, Roland Rogers, Jr.	South Sudbury	42 North College.
Dance, Darrell Alderson	Windsor, Conn.	25 North College.
Daniel, Douglas Gordon	Reading	33 North College.
Daniels, Richard Horace	North Adams	16 South College.
Daze, Rheal Edward	Willimansett	46 John Street, Willimansett.
DeAndrade, Frank [1]	Westport	12 South College.
Denmark, Hyman Samuel	Holyoke	9 South College.
Dexter, Ralph Warren	Gloucester	44 Sunset Avenue.
Doran, Dorothy Frances	Springfield	46 McClellan Street.
Dow, Hazel Marie	Springfield	22 Fearing Street.
Dressel, Alice Katherine	Granby	Abigail Adams House.
Duckering, Florence Augusta	Dorchester	Abigail Adams House.
Dunham, Wilmot Grant	Centerville	16 South College.
Dunphy, Charles Henry [2]	Palmer	12 South College.
Dupuis, Ellen Agnes	Southbridge	Abigail Adams House.
Durell, William Donald	Attleboro	6 North College.
Dwyer, John Walsh	North Hadley	Sunderland.
Edney, James Palmer	South Acton	29 North College.
Einbinder, Celia Harriet	Holyoke	Abigail Adams House.
Ellis, Catherine MacInnis	East Brewster	8 Allen Street.
Ennis, Clyde Nathaniel	Easthampton	5 Pleasant Street, Easthampton.
Entwistle, Charles Clifford	Mendon	97 Pleasant Street.
Esselen, William Brigham, Jr.	Millis	38 North College.
Farrar, John Biggs	South Lincoln	11 South College.
Fisher, Josephine Frances	Jamaica Plain	Abigail Adams House.
Fletcher, Everett Howard	Baldwin, L. I.	8 South College.
Flynn, James Henry	Easthampton	129 Park Street, Easthampton.
Forer, Ida	Holyoke	19 Pleasant Street.
Freedman, Alexander Harvey	Dorchester	56 Pleasant Street.
French, Chester Leroy	Greenfield	30 North College.
French, Marjorie Louise	North Easton	Abigail Adams House.
Frigard, Wilho	Maynard	12 South College.
Gagnon, Russell Thomas	Gloucester	85 Pleasant Street.
Gardner, Ruth Amy [2]	Island Pond, Vt.	Abigail Adams House.
Gilbert, Vincent Cooper [2]	Belmont	8 North College.
Ginsburgh, Irene Rebecca	Holyoke	Jefferson Apts., Holyoke.
Ginsburgh, Sylvan Jacob	Holyoke	Jefferson Apts., Holyoke.
Gooch, Oscar Randall [1]	Assinippi	5 North College.
Goodhue, John Russell	Ipswich	32 North College.
Gordon, Irwin Francis	Mattapan	56 Pleasant Street.
Gove, Leslie Julius	Revere	28 North College.
Green, Arthur Allerton	Windsor, Conn.	45 North College.
Griswold, Norman Bulkeley [2]	Hartford, Conn.	Sigma Phi Epsilon.
Hager, Fanny Abigail	South Deerfield	113 Main Street.
Hartford, Lionel Cyrus, Jr.	West Medford	62 Lincoln Avenue.
Harvey, Scott Heath	Amherst	101 West Street.
Harvey, Verne	Amherst	101 West Street.
Hatch, Benton Leroy	Holyoke	41 North College.
Haukelid, Knut Anders [2]	Oslo, Norway	10 South College.
Healey, Elsie Elizabeth	Lee	Abigail Adams House.
Henry, Ralph Joseph	Malden	50 Sunset Avenue.
Herbert, Charles Reitz	Squantum	17 Phillips Street.

[1] Candidate for the Degree of Bachelor of Vocational Agriculture.
[2] Admitted on probation, entrance record incomplete.

Hess, Alice Burnham	Springfield	Abigail Adams House.
Heywood, Dorothy Elizabeth	Westford	Abigail Adams House.
Hicks, Richard Ellsworth	Greenfield	Alpha Gamma Rho.
Hiland, Page Livingston	Great Barrington	15 South College.
Hill, Nathaniel Burtram	Amherst	32 North Prospect Street.
Hillberg, Pauline Louise	Pittsfield	Abigail Adams House.
Hinchey, Charles Humphrey	Palmer	86 Pleasant Street.
Hoagland, Descom DeForest	Waltham	6 Nutting Avenue.
Hobbie, Edward Humphreys	Mountain Lakes, N. J.	7 South College.
Hodgen, Alden Reginald	Leyden	Davenport Inn.
Hoffman, Archie Arthur	Boston	56 Pleasant Street.
Hoffmann, Arthur Frommer	Adams	10 South College.
Hovey, Albert Bancroft[2]	Wakefield	79 Pleasant Street.
Howes, Miner Stebbins[1]	Swift River	13 Phillips Street.
Hunter, Robert Packard	Melrose	37 North College.
Hutchins, Louise	Brookville	22 Fearing Street.
Jackson, Harriette Morgan	Orange	Abigail Adams House.
Jackson, Robert Crompton	New Bedford	8 South College.
Jenkins, Herbert	Methuen	Care of Professor Sears, Mount Pleasant.
Jensen, Marjorie Ann	Worcester	Abigail Adams House.
Kennedy, John Armstrong, Jr.	Red Bank, N. J.	23 North College.
Kibbe, Milton Homer	West Springfield	10 North College.
Kingsbury, Harlan Wesley	Braintree	86 Pleasant Street.
Kozlowski, William	Lynn	31 North College.
Kucinski, Karol Joseph	Amherst	15 North East Street.
Landsman, Eliot	Dorchester	14 South College.
Levy, Arnold James	Taunton	14 South College.
Lincoln, Stephan Albert	Oakham	9 North College.
Lister, William Seaton, Jr.	Stoneham	15 South College.
Lockhart, Janet Martha	Greenfield	70 Montague City Road, Greenfield.
Lojko, Joseph	Northampton	13 Warfield Place, Northampton.
Lucey, Alexander Ambrose, Jr.	Medford	22 North College.
MacCleery, Russell Eldridge	Winthrop	34 North College.
MacDonald, Kathleen Jane	Greenfield	22 Fearing Street.
Mackimmie, James Paige	North Amherst	North Amherst.
MacMackin, Carleton Archie	Lancaster	39 North College.
Magay, Robert Andrew	Worcester	17 North College.
McCarthy, Shirley Elizabeth	Greenfield	Care of Wm. MacIntosh, Amherst.
McGuckian, Ambrose Thomas	Roslindale	18 North College.
Merrill, Arthur Carlton, Jr.	Rockport	20 North College.
Merrill, James Willis	South Hadley Falls	179 Willimansett Street, South Hadley Falls.
Merritt, Robert Cairns	Williamsburg	44 Triangle Street.
Merritt, Helen Bartlett	Sheffield	Abigail Adams House.
Miranda, Adolfo Raefael[2]	Mexico City, Mexico	6 Nutting Avenue.
Mountain, David Charles[2]	Pittsfield	83 Pleasant Street.
Mulhall, William Paul	Ashland	27 North College.
Natti, Ilmar	Gloucester	43 North College.
Nichols, Nathan Paddock	Montpelier, Vt.	26 North College.
Nisbet, Fred Jouett	Roslindale	6 North College.
Noble, Robert Gillette	Florence	116 Pleasant Street.
O'Donnell, Elizabeth Eleanor	Easthampton	19 Phillips Street.
O'Neil, Cornelius Francis	Northampton	2 Warfield Place, Northampton.
Osgood, Bowyer Brockenbrough	Duxbury	11 South College.
Packard, Edward Lawrence	Amherst	8 Kellogg Avenue.
Papp, Walter Louis	North Falmouth	13 Phillips Street.
Peaslee, Sarah Augusta	Worcester	Abigail Adams House.
Pinneo, John Winthrop	Hinsdale	1 Hitchcock Street.
Politella, Joseph	Lawrence	44 Sunset Avenue
Pollock, Leo Herman	Chelsea	56 Pleasant Street.
Potter, Harold Carpenter	Greenfield	42 North College.
Powers, Helen Louise	Hadley	41 Russell Street, Hadley.
Pozzi, John Frank	North Adams	11 North College.
Pushee, Ruth	North Amherst	North Amherst.
Pyenson, Harry	East Lee	14 South College.
Ramsdell, Eleanor Wardwell	Andover	Abigail Adams House.
Reynolds, James Norris, Jr.	Agawam	81 Pleasant Street.
Rhinehart, Phyllis Alice	Lanesboro	19 Phillips Street.
Riley, Agnes Clare[2]	Allston	46 McClellan Street.
Rix, Lloyd Parsons	Putney, Vt.	15 North College.
Robertson, James Walter, Jr.	Dorchester	18 North College.
Rogers, Mark Henry	West Newbury	10 South College.
Rogers, Milton Josselyn[1]	South Hanover	38 North College.
Rowland, Laura Elizabeth	Springfield	Abigail Adams House.
Royal, Raymond Edward	Adams	3 North College.
Ryan, Alvan Sherman	Needham Heights	27 North College.
Schaffner, Paul Webster	Dover	7 North College.
Schenck, Wolcott Lawrence	Longmeadow	29 North College.
Schlaefer, William Valentine	Englewood, N. J.	35 North College.
Schwatz, Carl Samuel	Springfield	6 Nutting Avenue.
Scott, Marion Cornelia	Bloomfield, Conn.	Abigail Adams House.
Sealey, John Clifford, Jr.	Southboro	22 North College.
Seperski, Stanley Francis	East Pepperell	2 North College.

[1] Candidate for the Degree of Bachelor of Vocational Agriculture.
[2] Admitted on probation, entrance record incomplete.

Shattuck, Willard Winthrop[2]	Hubbardston	72 Lincoln Avenue.
Shatz, Bertram	Springfield	81 Pleasant Street.
Shea, John Joseph	Turners Falls	66 Lincoln Avenue.
Shemwick, Otto Louis	Seymour, Conn.	83 Pleasant Street.
Sherman, Albert	Stoneham	56 Pleasant Street.
Sibson, James Albert	Milford	4 North College.
Sievers, Howard Ralph	Amherst	44 Amity Street.
Simmons, Gladys Josephine	Pittsfield	Abigail Adams House.
Skipton, Alberta Elizabeth	Springfield	8 Allen Street.
Smiaroski, Joseph Nuckoski	Deerfield	12 South College.
Smith, Donald Hartwell	South Berlin	8 South College.
Smith, Edith Janette	State Line	Abigail Adams House.
Snow, Elizabeth Wells	Granby	Abigail Adams House.
Snow, Russell Linnell	Arlington	President's House.
Solomon, Barnett	Malden	9 South College.
Southworth, Warren Hilbourne	Lynn	31 North College.
Steffek, Edwin Francis	Westfield	28 North College.
Stockbridge, Robert Reed[1]	Worcester	45 North College.
Stoeber, Florence Pauline	Adams	Abigail Adams House.
Sturtevant, Russell	Halifax	7 South College.
Taft, Russell Eugene	Greenfield	5 North College.
Talbot, Edward James	North Wilbraham	Sigma Phi Epsilon.
Taylor, Elizabeth Alton	Holyoke	46 McClellan Street.
Taylor, John Joseph	Great Neck, N. Y.	12 North College.
Taylor, Mary Isabelle	Groton	Abigail Adams House.
Thomas, Winthrop Snowden	South Middleboro	21 North College.
Thomson, Chester Willard	West Rutland, Vt.	Colonial Inn.
Thompson, Walter Earl, Jr.	Holyoke	18 Nutting Avenue.
Thompson, Wallace Wetherell	Worcester	15 North College.
Tiffany, Grace Elizabeth	Holyoke	Care of Mr. Lanphear, Farview Way.
Tomlinson, Mary Arundale	West Newton	Abigail Adams House.
Townsend, Eleanor	Worcester	Abigail Adams House.
Walker, Henry Atchison	Southbridge	16 North College.
Watson, Vernon Kenneth	Amherst	5 East Pleasant Street.
Weinberger, Benjamin	Dorchester	14 South College.
Wetmore, Charles Herbert, Jr.	Needham	20 North College.
Wheeler, Elizabeth	Worcester	Abigail Adams House.
Wheeler, Nelson Adrian	Holyoke	13 North College.
White, Howard Eric	Worcester	2 North College.
Wilcox, Joan Elizabeth	Jamaica Plain	Abigail Adams House.
Woodbury, Frances	Malden	Abigail Adams House.
Wordell, Hillman Hathaway	Somerset	16 South College.
Wyman, Edward Rockford	Turners Falls	17 Phillips Street.
Zielinski, Joseph Francis	Holyoke	13 North College.

SPECIAL STUDENTS.

Derby, Llewellyn Light	Amherst	81 Pleasant Street.
Efimchenko, Basil Matthew	Russia	Mathematics Building.
Keene, Edwin Emil	Roslindale	French Hall.

REGISTERED AFTER THE CATALOGUE FOR 1929 WAS PUBLISHED.

1932.

Kiley, Mary	Adams.	

1933.

Dean, Merritt	North Pownal, Vt.	

SUMMARY BY CLASSES.

Class.	Men.	Women.	Total.
1931	84	30	114
1932	95	30	125
1933	122	42	164
1934	178	61	239
Specials	3		3
Total	482	163	645

GEOGRAPHICAL SUMMARY.

Massachusetts	608	Albania	1
Maine	1	England	1
New Hampshire	1	Holland	1
Vermont	5	Mexico	1
Connecticut	8	Norway	1
Rhode Island	1	Russia	1
New York	5		
New Jersey	9	Total	645
Pennsylvania	1		

[1] Candidate for the Degree of Bachelor of Vocational Agriculture.
[2] Admitted on probation, entrance record incomplete.

STOCKBRIDGE SCHOOL OF AGRICULTURE.

GRADUATES, 1930.

William Henry Arnott	Fitchburg.
Willard Wendell Avery	East Kingston, N. H.
Harold Frederick Bailey	Southboro.
Richmond Cushman Barr	Worcester.
Mary Beaumont	Saxonville.
Charles Young Becker	Westport, Conn.
Edgar Stanley Bolles, Jr.	Monument Beach.
Floretta Ten Broeck Brainard	Springfield.
Eugene Sturgis Brookings	West Newton.
Ralph Leonard Brown	Portsmouth, N. H.
George Emil Burkhardt	Worcester.
John Stephen Byron	Hadley.
John Joseph Carlon	Northampton.
Richard Burrell Caswell	Lakeville.
Samuel C. Chapin, Jr.	East Longmeadow.
Joseph Robert Cleary	Lynn.
Herman Couture	Warren.
Joseph Henry Coyle	Somerville.
Elmer Matthews Crockett	Rockport, Me.
James Henry Curran	Danvers.
Thomas Edward Curran	Danvers.
Arthur John Cutrumbes	Dracut.
Charles Henry Derby, Jr.	Paxton.
Everett Tatman Dimock	Oxford.
Joseph Donald Donnis	Hatfield.
Francis Anthony Doucette	East Braintree.
William J. Eva, Jr.	Springfield.
Norman Seward Felch	Salisbury.
Doris Leona Feltham	Springfield.
Katherine Taber Fox	Cambridge.
Nelson Bernerd Fox	Dracut.
Joseph Lawrence Goduti	Somerville.
Helen Gottfried	Tryon, N. C.
Arvo Otto Hakkinen	Gardner.
Herbert Francis Haley	Orange.
Francis Edward Hart	Whitman.
Winston J. Hartley	Waltham.
Judson W. Hastings	Agawam.
Sumner Warren Hebblethwaite, Jr.	Islington.
Jason Hartwell Hill	North Brookfield.
Chester Whitmore Holt	Georgetown.
Alfred Thomas Jubenville	Hatfield.
Theodore Kastberg	Worcester.
Edwin Emil Keene	Roslindale.
Richard McLearn Kinsman	Middleboro.
Meredith Francis Knight	Westhampton.
Nathan Lassman	Haverhill.
Richard Henry Lee	Northampton.
Walden Phillips Lewis	South Braintree.
Arne Victor Liukas	Gardner.
Allan William Lynn	Brockton.
Hugh Ruyter MacGibbon	Northfield, Vt.
Robert Jerome Mann	Worcester.
William Edward Messier	North Adams.
Edwin Milligan	South Groveland.
Lester Trowbridge Morrill	Brockton.
Samuel Leon McCoy	Roxbury.
Allan Stanford McGrath	Dedham.
Francis John O'Grady	Milford.
Arne Edward Oksanen	Fitchburg.
Charlie Roswell Peabody	Gorham, N. H.
Arthur Nelson Phelon	Granville.
Norman Bennett Quick	West Springfield.
Barney Rafkin	Brockton.
Howard Lewis Rich	Athol.
Harold Raymond Rindge	Palmer.
Clinton Scott Roberts	Bristol, Conn.
Robert Hyman Rosenthal	West Springfield.
Leroy Lincoln Rounseville	Middleboro.
Joseph P. Schwartz	Revere.
Alfred Julius Shats	West Hanover.
Elizabeth Sherman	North Marshfield.
Arthur Willard Smith	Williamsburg.
Christopher Frederick Smith	Holyoke.
Donald Henry Stone	Shrewsbury.
Agnes Tamm	Astoria, N. Y.
Edmund Fernald Taylor	Fleetwood, Penna.
Richard Hadley Tracy	Windsor, Vt.
John Joseph White	Fall River.
Lincoln White	Abington.
Keith Hinton Wilcox	Port Leyden, N. Y.
Douglas Craig Wilson	Bolton.
Edwin Porter Wood	Dalton.
Clinton Everett Woodward	Taunton.
Ernest Howard Worthington	Auburn.
Henry Adam Zimmerman	Auburn.
Joseph Valentine Ziomek	Amherst.

GRADUATES AS OF THE CLASS OF 1929.

Kenneth Malcolm Brackley	Strong, Me.
Keith Graham Eldredge	Sagamore.
Edward Francis Gorham	South Braintree.
George William McCarthy	Northampton.
George Irvin Stearns	Carlisle.
Clarence Eugene Stevens	Marlboro.
Louis Alton Witt	North Brookfield.

CLASS OF 1931.

Ahrens, Alfred Herman	Bronx, N. Y.	15 Cottage Street.
Allen, Stuart Harlow	Shrewsbury	17 Phillips Street.
Andrews, Warner Childs	Watertown	Kolony Klub.
Bairstow, Harry Joseph	Malden	Kolony Klub.
Bancroft, Floyd Upton	Tyngsboro	Cosby Avenue, Care of Mr. Bolter.
Barber, George Albert	Somerville	10 McClellan Street.
Blatchford, Lawrence Eaton	Attleboro	14 Orchard Street.
Boardman, Edgar Shears	Sheffield	108 Pleasant Street.
Brown, Stuart Gilmore	North Attleboro	75 Pleasant Street, A. T. G.
Brox, John	Dracut	42 Cottage Street.
Bruscoe, Stephen Francis	West Hatfield	14 McClellan Street.
Buell, Harry Clemens	Petersham	Kolony Klub.
Buell, Murray Fife	Shelburne Falls	17 Northampton Rd.
Burbank, Norman Ballou	West Somerville	Kolony Klub.
Burke, Thomas Francis	Woburn	75 Pleasant Street, A. T. G.
Bush, Ralph Loomis	Holyoke	13 Hallock Street.
Butler, Edward William	Holyoke	Mt. Pleasant, care of C. L. Thayer.
Carroll, John Paul	Salem	35 Lincoln Avenue.
Chase, Lyman M.	Littleton	66 Lincoln Avenue.
Cobb, John Francis	Roslindale	75 Pleasant Street, A. T. G.
Coolidge, Frank Arthur, Jr.	Barre	North Pleasant Street, Care of Mrs. Carey.
Coville, Richard Prentiss	Cummaquid	75 Pleasant Street, A. T. G.
Crocker, Richard Cushing	Duxbury	75 Pleasant Street, A. T. G.
Crocker, Robert Sears	Duxbury	75 Pleasant Street, A. T. G.
Doane, George Hubbard	North Brookfield	29½ Lincoln Avenue.
Dostal, Edward Joseph	Northampton	Northampton.
Duffill, John Winthrop	Melrose	Davenport Inn.
Duponte, Charles William	Nantucket	17 Phillips Street.
Dykman, Robert William	Westport, Conn.	25 Gray Street.
Faulk, Wesley Snow	Brockton	75 Pleasant Street, A. T. G.
Fenton, Francis Xavier	West Roxbury	108 Pleasant Street.
Field, John	Mattapoisett	Kolony Klub.
Fish Ozro Meacham	Concord	50 Sunset Avenue.
Foskit, George Leonard	Three Rivers	Kolony Klub.
Foster, Philip W.	Lowell	84 Pleasant Steet.
Glidden, Robert Norwood	North Middleboro	75 Pleasant Street, A. T. G.
Greene, William T.	Lowell	East Pleasant Street, Care of Mrs. Warnock.
Griffin, Michael Joseph	Amherst	3 Shumway Street.
Hare, John Wells	Springfield	56 Pleasant Street.
Hartford, Myron Chester	Lowell	Poultry Plant.
Hatheway, Frank Wilson	Amherst	Draper Hall, M. A. C.
Higgins, Fred L.	Orleans	17 Kellogg Avenue.
Hildreth, Earl Joseph	Worcester	56 Pleasant Street.
Hoyt, George Raymond	Merrimac	28 Pleasant Street.
Hueg, Harold Cleveland	Wellesley	Kolony Klub.
Hulbert, Howard Marshall	Holliston	75 Pleasant Street, A. T. G.
Jones, Edward George	Ashland	65 Pleasant Street.
Keady, Joseph Francis	Rockland	86 Pleasant Street.
Kellogg, Richard Alvin	Feeding Hills	75 Pleasant Street, A. T. G.
Kerxhalli, Ligor Pandi	Worcester	North Amherst, Care of Mrs. Shampo.
Kyle, Alfred	Northampton	Northampton.
Lewis, Richard Grinnell	Framingham	75 Pleasant Street, A. T. G.
Little, John Miller	Marshfield Hills	28 Pleasant Street.
Lund, Harold Clifford	Shrewsbury	17 Phillips Street.
Maroney, Donald Thomas	Uxbridge	17 Phillips Street.
Mongillo, Leonard X.	Southington, Conn.	126 Hillside Avenue.
Moore, Arthur Phillips	West Peabody	Kolony Klub.
Moulton, Parker Edward	Peabody	75 Pleasant Street, A. T. G.
Murray, Henry Stephen	Concord	Kolony Klub.
McCaffrey, Thomas Francis	Roslindale	Kolony Klub.
McKechnie, Robert M.	Natick	Kolony Klub.
McWilliams, Arthur Gilbert	Hackensack, N. J.	25 Gray Street.
Nelson, Alfred Warran	Randolph	Baker Lane, Care of Mrs. Webb.
Nelson, Lawrence Ingvall	Petersham	Kolony Klub.
Niles, Sherman Murray	Williamstown	75 Pleasant Street, A. T. G.
Perry, Arthur Hudson	Barre, Vt.	Kolony Klub.
Petersen, Ernest Arthur	Framingham	75 Pleasant Street, A. T. G.
Peterson, William Bertil	Lexington	1 Cottage Street.
Pilling, Thomas Linwood	Worcester	46 Pleasant Street.
Proctor, Donald Powers	Spencer	3 Hallock Street.
Purdy, Harris Henry	Merrimac	Kolony Klub.
Reed, Francis George	Portland, Me.	75 Pleasant Street, A. T. G.
Reynolds, John	Falmouth	3 McClure, Care of Mrs. Morin.
Rice, Harold Francis	Norwood	75 Pleasant Street, A. T. G.

Robertson, Charles Albert	Somerville	Kolony Klub.
Rodman, Elizabeth	Wickford, R. I.	Draper Hall.
Rogers, Eliot Francis	West Newton	Kolony Klub.
Seaver Margarita	Buzzards Bay	Draper Hall.
Shibles, Clinton Andrew	Rockport, Me.	75 Pleasant Street, A. T. G.
Smith, A. Weston, Jr.	Bronxville, N. Y.	Kolony Klub.
Sornborger, Isabel Tyler	West Springfield	Draper Hall.
Stalker, Barbara Alice	Framingham	Draper Hall.
Sundberg, Lawrence Elroy	Brockton	30 North Prospect Street.
Twohig, James Francis	Springfield	75 Pleasant Street, A. T. G.
Twohig, William Patrick	Springfield	75 Pleasant Street, A. T. G.
Vik, John Henry	Wakefield	R. F. D. No. 3, Box 77.
Warren, Albert Francis	Medford	1 Cottage Street.
Watt, Lewis Cavine	Somerville	Kolony Klub.
Webb, William Kenneth	Oakham	Davenport Inn.
Webster, Howard Sheldon	Haverhill	44 Sunset Avenue.
Wheaton, Lloyd Ellsworth	Dartmouth	75 Pleasant Street, A. T. G.
Whitney, Oakley Fayne	Orange	86 Pleasant Street.
Whittington, Charles Richard	New York City, N. Y.	44 Sunset Avenue.
Woodbury, Richard Emerson	Fitchburg	Care of Fred Cooley, Sunderland.

CLASS OF 1932.

Abbott, Thomas Lewis	Bellows Falls, Vt.	31 East Pleasant Street.
Adams, Myra Louise	West Brookfield	Draper Hall.
Babb, Lois Lumbert	Mill River	Draper Hall.
Baker, Robert Lee	Middleboro	84 North Pleasant Street.
Batchelor, Douglas Stanley	Athol	126 Hillside Avenue.
Beaton, Gilbert Thomas	West Wareham	5 Allen Street.
Bent, Albert	Newton	12 Chestnut Street.
Bernier Laurent Victor	Northampton	Northampton.
Bishop, Harold Whitney	Springfield, Vt.	4 Hallock Street.
Booker, George Ival	Corinna, Me.	9 Phillips Street.
Bossidy, Robert Haig	Lee	11 Cottage Street.
Bourdo, Ebert Edward	Dalton	6 Railroad Street.
Bowen, Frank Arnold	Cherry Valley	62 Pleasant Street.
Bowen, James Myron	Erving	45 Fearing Street.
Brown, Walter Lawrence	Bryantville Centre	9 Phillips Street.
Bruce, Leo Ivan, Jr.	Holliston	Baker Lane, Care of Mrs. Dillingham.
Burnham, Leonard Augustus	Gloucester	26 Fearing Street.
Carpenter, Duane Frederick, Jr.	Bedford	42 Cottage Street.
Carreiro, Joseph Nunes, Jr.	Portsmouth, R. I.	North Pleasant Street, Care of Mrs. Newlon.
Carter, Louise	Hanson	Draper Hall.
Charles, Urban Jay	Framingham	45 Fearing Street.
Clark, Horace Herbert	West Springfield	9 Fearing Street.
Clogston, Richard Mark	Hyde Park	7 Phillips Street.
Connell, Frank Joseph	Malden	Baker Lane, Care of Mrs. Webb.
Cromie, Gilbert James	Andover	14 McClellan Street.
Cummings, Howard Adna	Canton, Me.	108 Pleasant Street.
Davis, Katherine Orne	Swampscott	8 Triangle Street.
Davis, Norman Phillip	Stoneham	Baker Lane, Care of Mrs. Dillingham.
Dawson, Charles William	Lynn	5 Allen Street.
de Prado, Theodore Harding	Crestwood, N. Y.	4 Cosby Avenue, Care of Mrs. Pickering.
Descheneaux, Omer Roy, Jr.	Lowell	126 Hillside Avenue.
Dick, Ralph	Springfield	52 Lincoln Avenue.
Diggin, John Leo	Dorchester	30 North Prospect Street.
Dolan, Francis Albert	Billerica	72 Lincoln Avenue.
Dunivan, Levi Alan	Acton	Baker Lane, Care of Mrs. Webb.
Edman, Martin Emmanuel	Fitchburg	North Pleasant Street, Care of Mrs. Shampo.
Ek, John Harold	Brockton	13 Hallock Street.
Faszczewski, Joseph Julius	Brockton	30 North Prospect Street.
Field, Lawrence	Williamstown	45 Fearing Street.
Fiske, Daniel Smith, Jr.	Grafton	The Perry Hotel.
Fowler, Howard	Hampden	Hampden.
Galbraith, Floyd M.	Greenfield	14 McClellan Street.
Gamester, Frederic	Lynn	30 North Prospect Street.
Garland, Arthur Lindsay	Cambridge	15 Cottage Street.
Granger, John David	Dalton	6 Railroad Street.
Grant, William Henry, 2d	Springfield	45 Fearing Street.
Gray, Richard Howes	Dennis	4 Cosby Avenue, Care of Mrs. Bolter.
Grody, Saul Harold	Chelsea	Eames Avenue, Care of Mrs. Warnock.
Guidoboni, Horace Didimo	Middleboro	10 Cosby Avenue.
Hall, Samuel Olney	Medford	3 McClure Street.
Hanby, Walter Edward	Brockton	30 North Prospect Street.
Henry, David Stephens	Wallingford, Conn.	Mt. Pleasant, Care of Mrs. Greene.
Hill, Norman Morse	Framingham	3 Nutting Avenue.
Howe, Arthur William	Brookfield	3 McClure Street.
Howes, Miner Stebbins	Cummington	13 Phillips Street.
Jaeschke, Emil	Adams	10 McClellan Street.
Jewett, Lawrence Lee	Enosburg, Vt.	Baker Lane, Care of Mrs. Dillingham.
Keith, Kenneth Edwin	Bridgewater	4 Hallock Street.

Kendall, Harold Archer	Rockland	86 Pleasant Street.
Keohan, Francis Lawrence	Weymouth	15 Cottage Street.
Kibby, William Vernon	Pittsfield	10 Cosby Avenue, Care of Mrs. Bolter.
Kinnear, Kenneth Alden	Gardner	45 Fearing Street.
Kneeland, Paul Grosvenor	Sterling	13 Hallock Street.
Kovar, Stephen David	Brookline	14 McClellan Street.
La France, Melvin James	Northampton	Northampton.
Leland, Charles Lyman	East Bridgewater	4 Hallock Street.
Liljegren, Solveig Ubne	Quincy	8 Triangle Street.
Liu, Sara	Foochow, China	Draper Hall.
Low, Curtis Maynard	Dedham	1 Cottage Street.
Macquinn, William Edward	South Weymouth	3 Hallock Street.
Marsh, Arthur Edward	Berlin	72 Lincoln Avenue.
Mason, Robert Burnham	Princeton	13 Hallock Street.
Matthew, James Royal	Dedham	7 McClellan Street.
Mayhew, Charles Henry	Middleboro	10 McClellan Street.
Metzler, Robert Maxwell	Somerville	9 Phillips Street.
Mills, Robert Johnson	Belmont	13 Hallock Street.
Mistarka, Stanley James	Northampton	Care of Mr. E. Gaskill.
Mitchell, Lewis Jesse	Somerville	86 Pleasant Street.
Moos, George Edward	South Hadley Falls	108 South Pleasant Street.
MacAdams, Leslie Mears	Chelsea	12 Cottage Street.
MacLeod, Kenneth Angus	Ipswich	North Pleasant Street, Care of Mrs. Carey.
McAvoy, Walter Edward	Boston	7 Phillips Street.
McCarty, Hubert Turner	Bath, Me.	4 Chestnut Street.
McNulty, Maurice Francis	Longmeadow	101 Pleasant Street.
Neely, Henry Herbert	Madison, Conn.	62 Pleasant Street.
Nelson, Arthur Yngve	Brockton	30 North Prospect Street.
Noren, Nelson Fred	Bridgeport, Conn.	Eames Avenue, Care of Mrs. Johnson.
Nye, William Frank	Springfield	9 Fearing Street.
O'Connor, Thomas P.	Holyoke	3 McClure Street.
O'Gara, John Patrick	South Hadley Falls	3 McClure Street.
O'Leary, Francis William	Arlington	Baker Lane, Care of Mrs. Webb.
Ormachea, Nestor	Jackson Heights, L. I., N. Y.	Eames Avenue, Care of Mrs. Warnock.
Pearson, Leon Everett	Lynnfield Centre	72 Lincoln Avenue.
Pearson, Stanley Duff	Briarcliff Manor, N. Y.	3 Nutting Avenue.
Pedigo, Elizabeth Jackson	Ronceverte, W. Va.	8 Triangle Street.
Perkins, William Nelson	East Bridgewater	6 Kendrick Place.
Planitzer, Walter William	Lawrence	18 Cottage Street.
Pond, Eldon Dexter	Holliston	Baker Lane, Care of Mrs. Dillingham.
Queen, John Waters	Quincy	42 McClellan Street.
Rabbitt, Timothy Paul	Holyoke	3 McClure Street.
Reynolds, Henry	Milton	Baker Lane, Care of Mrs. Webb.
Richards, Clinton Howard	Springfield	42 McClellan Street.
Ricker, Earle Alnerdo	Duxbury	4 Cosby Avenue, Care of Mrs. Pickering.
Robinson, Floyd Greenwood	Winchester	50 Sunset Avenue.
Robinson, Frank Tufts, Jr.	Cambridge	15 Fearing Street.
Rollins, Virginia	Jamaica Plain	Draper Hall.
Rood, Chester McCord	New Haven, Conn.	18 Cottage Street.
Roper, Clarence Grant	Westminster	15 Cottage Street.
Ross, Elton James	Milton	Baker Lane, Care of Mrs. Webb.
Ryan, Maurice Stephen	Peabody	7 Phillips Street.
Saalfrank, Joseph Carl, Jr.	Lawrence	18 Cottage Street.
Salo, Victor Veikko	Millbury	84 Pleasant Street.
Schulman, Leonard Leo	South Boston	1 Cottage Street.
Schwartz, Maurice	Dorchester	Davenport Inn.
Sheridan, John Francis	Clinton	7 Phillips Street.
Short, Philip Cutler	Springfield	18 Cottage Street.
Sime, Lloyd Hawthorne	Brockton	13 Hallock Street.
Skelton, Edgar Warren	Newton Highlands	3 McClure Street.
Slater, Gordon Elliot	Lexington	126 Hillside Avenue.
Smith, Hugh Chaplin	Lawrence	86 Pleasant Street.
Soares, Manuel Paul	Fairhaven	12 Chestnut Street.
Stedman, Sherwood Carlton	Brockton	30 North Prospect Street.
Stratton, Ralph Edward	Boston	3 Hallock Street.
Sullivan, James Anthony	Holyoke	Mt. Pleasant, Care of Professor Thayer.
Tarlow, Nat	Revere	16 Hallock Street, Care of Mrs. Thomas.
Thatcher, Eleanor Charlotte	Athol	Draper Hall.
Thurber, Stuart Johnson	Brattleboro, Vt.	86 Pleasant Street.
Toko, Leo Verner	Fitchburg	Baker Lane, Care of Mrs. Webb.
Trott, Robert Langdon	Andover	14 McClellan Street.
Turner, Marjorie Hazel	Yarmouthport	Draper Hall.
Varvantacy, Anthony	Shrewsbury	Aggie Inn.
Vuornos, Bruno Kalervo	Brighton	5 Nutting Avenue.
Walsh, Stanley Matthew	Longmeadow	126 Hillside Avenue.
Warren, Daniel William, Jr.	Brookline	30 Hillside Avenue.
Washburn, Reginald Sherman	Middleboro	10 Cosby Avenue.
Watts, Gilbert Curtis	Whitman	7 McClellan Street.
Weidlich, Henry Kurt	Springfield	42 McClellan Street.
Wheeler, Chester Clinton	Amherst	32 Belchertown Road.

Whitcomb, Donald Albert	Somerville	Baker Lane, Care of Mrs. Webb.
White, Howard Bertram	Ashby	18 Cottage Street.
Whitmore, Charles Gilbert	Forestdale	8 Kellogg Avenue.
Whitney, Leonard Rogers	Pittsfield	81 Pleasant Street.
Wilder, Eleanor Mary	Brookline	Draper Hall.
Wiley, Arthur Lyman, Jr.	Wakefield	Davenport Inn.
Williams, Dwight Keble	West Haven, Conn.	17 Kellogg Avenue.
Williams, Ormond Kameron	Bridgeport, Conn.	9 Phillips Street.
Wyatt, Ralph	Fairview, Penna.	Baker Lane, Care of Mrs. Webb.

SPECIAL STUDENT.

Allis, Jean M.	Amherst	13 Lincoln Avenue.

SUMMER SCHOOL, 1930.

Graduate Students. (See list on page 130.)

Underyraduate Students.

Astore, John J.	West Stockbridge.
Avery, Jeanette V.	Springfield.
Avila, Laura O.	New Bedford.
Baker, Dorothy M.	Millers Falls.
Barlow, Helen W.	Amherst.
Bias, Helen	Amherst.
Bishop, Herbert L., Jr.	Worcester.
Bonney, Walter T.	Springfield.
Boyd, Hope E.	Bradford.
Brierley, Marcella I.	Fall River.
Brown, Lena	Worcester.
Brown, Marguerite	Amherst.
Burnham, John	Shelburne Falls.
Byrne, Margaret M.	Northampton.
Cain, George	Braintree.
Carbee, Ruth M.	Dorchester.
Carl, George T.	Dighton.
Carter, Esther B.	Amherst.
Chapman, Gean M.	Bradford.
Church, Gertrude	North Amherst.
Coldwell, Archibald G.	Saugus.
Costello, John P.	Franklin.
Doerpholz, Eunice M.	Holyoke.
Doherty, Mary B.	Mattapan.
Donaghy, Edward J.	New Bedford.
Doyle, Robert T.	Florence.
Drury, Doris C.	Northampton.
Dunn, Luella C.	Gardner.
Dyer, Cora G.	Northampton.
Efimchenko, Basil M.	Russia.
Fenton, Ruth C.	Northampton.
Flach, Erna M.	Northampton.
Gallagher, Charles F.	Springfield.
Gillespie, Grace C.	South Braintree.
Gilmore, Ruth M.	West Springfield.
Gleason, Irene	Northampton.
Glynn, Marion L.	Amherst.
Goodrich, Raymond	Amherst.
Goodwin, Azor O.	Marblehead.
Grenier, Geraldine	Northampton.
Hackett, Olive E.	South Weymouth.
Handforth, Kathryne L.	West Medway.
Hanslick, Otis	Somerville.
Harrington, Mary E.	North Amherst.
Haskins, Esther L.	North Dartmouth.
Heywood, Dorothy	Westford.
Hill, Priscilla E.	Worcester.
Hoffman, Anne	Holyoke.
Hollis, Lucie E.	South Weymouth.
Holway, Alfred H.	Holyoke.
Howlett, Linda	Southampton.
Hubbard, Catherine N.	Sunderland.
Hugenberger, Reba	Decatur, Ill.
Johnson, Catharine G.	Amherst.
Johnson, William A.	Haverhill
Kaylor, John D.	Fall River.
Keedy, Flora B.	Amherst.
Keene, Edwin E.	Roslindale.
Kennedy, Anna M.	Westfield.
Kennedy, Margaret W.	Westfield.
Killeen, John B., Jr.	Cambridge.
King, Kathleen G.	South Amherst.
La Montagne, Mable	Northampton.
Lake, Susie G.	Avon.
Leland, Helen H.	Holliston.
Levine, Harry O. H.	Springfield.
Liu, Sara	Foochow, China.
Lo Bello, Frances	Northampton.
Locke, Alice B.	Winchester.
McCann, Frances B.	Fall River.
McCarron, Anna T.	Boston.
McCarron, Frances B.	Boston.

McKenna, Mary L.	New Bedford.
Maloney, Margaret G.	Northampton.
Mamaqui, Nusret O.	Albania.
Marshall, Edith M.	North Adams.
Martin, Irene M.	Northampton.
Martin, Margaret	Amherst.
Merrill, Neale E. J.	Ware.
Miller, Donald R.	Northampton.
Monk, Marjorie	Longmeadow.
Morse, Ellen H.	Amherst.
Morton, Sylvia S.	Conway.
Norell, Frieda	Amherst.
Northcott, John W., Jr.	New Bedford.
Nowlan, Elizabeth T.	Amherst.
Oberg, Elizabeth A.	Sandwich.
O'Connor, Margaret A.	Northampton.
Parker, Catherine S.	Attleboro.
Peck, Elizabeth D.	Greenfield.
Perkins, Isabel R.	Worcester.
Pike, Anita L.	Dorchester.
Pollard, Robert L.	Amherst.
Pray, Francis C.	Amherst.
Rae, James H.	Lawrence.
Ramsdell, Eleanor W.	Andover.
Raplus, Harry E.	East Longmeadow.
Readio, Marian A.	Florence.
Reed, Elizabeth	Dalton.
Reed, Virginia	Waltham.
Richardson, Alice	Franklin.
Richmond, Phyllis R.	East Bridgewater.
Roberts, Roger E.	South Hadley Falls.
Salenius, Charles H.	Hingham.
Shaw, Doris E.	Amherst.
Smith, Grace R.	East Bridgewater.
Stiles, Vernon D.	Hadley.
Sylvester, George S.	Glen Rock, N. J.
Taylor, John J.	Great Neck, N. Y.
Thomson, Mary E.	Amherst.
Vondell, John H.	Amherst.
Warren, Philip W.	West Auburn.
Watson, Edward W.	Plymouth.
Wilcox, Keith H.	Port Leyden, N. Y.
Wilk, Joseph A.	Adams
Williams, Inez W.	Brockton.
Wright, Vera I.	Northfield.

WINTER SCHOOL, 1930.

Amatt, Percy	Northampton.
Badger, Lester	Norwood.
Beaubien, Joseph	Montague.
Berendse, Henry	Bristol, Conn.
Bergeron, Romeo O.	New Bedford.
Bohne, Charles O.	Louisville, Ky.
Bowser, Fred H., Jr.	Woburn.
Brown, Kenneth R.	Lewiston, N. Y.
Burkhardt, Harry	Rocky River, Ohio.
Burns, Harry B., Jr.	Bradford Woods, Pa.
Cahill, Francis M.	Haverhill.
Call, Harry B.	Methuen.
Campbell, Earl L.	Littleton, N. H.
Caporale, Peter A.	Middleboro.
Cassell, George H.	Balboa Heights, C. Z.
Clapp, Richard	Gill.
Davis, Ralph S.	Rutland, Vt.
Deary, Thomas C.	Webster.
De Groot, Louis	Wellfleet.
Durbin, Lewis E.	South Amherst.
Ellis, James	Sharon, Conn.
Flynn, George	Mattapan.
Foley, David A.	Framingham.
Ford, Weston	East Weymouth.
Frye, Albert M.	Leominster.
Gelinas, J. Hermann	Biddeford, Me.
Gordon, Arthur	Rawley.
Gustafson, Arnold	Batavia, Ill.
Henderson, Arthur	Andover.
Howard, William W.	Louisville, Ky.
Howe, Thomas	Wellesley Hills.
Howes, Edward C.	Stoneham.
Hunt, Elbert	Pleasantville, N. Y.
Johnston, Joseph	Wakefield.
King, Harold A.	Feeding Hills.
Kosiorek, Walter J.	Westfield.
Lally, John J.	Fall River.
Lane, Walter E.	Spencer.
Larson, Albert B.	Rockport, Me.
Lariviere, Gerard R.	Southbridge.
Leonard, Lloyd	Taunton.
Leonard, Charles	Taunton.
Madden, Edward	Webster.
Maynard, Carol	Worcester.

Manaker, Maurice B.	Hartford, Conn.
Mauro, Arthur A.	Marlboro.
Mitchell, Charles E.	North Scituate.
Mitchell, Chauncey L., Jr.	Winchester.
McBride, William J.	Nashua, N. H.
McGregor, Robert	Hastings-on-Hudson, N. Y.
McNamara, John	Aspinwall, Penn.
O'Keefe, Charles T.	Peabody.
Osterlitz, George	Schenectady, N. Y.
Parsons, Atherton	Southampton.
Pauli, James M.	Three Rivers, Mich.
Peterson, Edward J.	Sterling.
Piasta, Francis D. S.	Dudley.
Pickard, Hobart L.	Littleton.
Picard, George H.	Framingham.
Ray, Mrs. C. E.	Johnstown, N. Y.
Reed, Frank H., Jr.	Greenfield.
Reponen, Arne	Gardner.
Reynolds, John, Jr.	Falmouth.
Ritchie, Lillian	Holliston.
Robinson, Edward E.	Dexter, Me.
Rogers, Elton	Westboro .
Rose, Manuel	South Dartmouth.
Rzeczkowski, Alan J.	Amherst.
Schatz, Beatrice S.	Norwich, Conn.
Schofield, Clarence	Abington.
Shaw, M. Loran, Jr.	Lowell.
Shrum, Benjamin	Los Angeles, Calif.
Shuman, Jack	Dorchester.
Snow, William L.	Chicago, Ill.
Somerville, David	Woburn.
Stott, Lloyd G.	Fall River.
Stuper, William F.	Virden, Ill.
Tibbetts, Clarence	Watertown.
Towne, Orville D.	Schuylerville, N. Y.
Turner, Arthur R.	Marlboro.
Wade, E. Marion	Holliston.
Wetterlow, Lester	Malden.
Winterbottom, Carl	Forest Hills, N. Y.

Summary of Short Course Enrollment.

	Men.	Women.	Total.
Stockbridge School of Agriculture:			
Second year	89	4	93
First year	136	11	147
Winter School, 1930	79	4	83
Summer School, 1930 (exclusive of Graduate Students)	39	78	117
Special		1	1
Totals	343	98	441

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Gifts and Bequests.

For the information of those who wish to make a gift or a bequest to this College, the following suggestion is made as to the form which may be used.

"I give (and bequeath) to the Trustees of the Massachusetts Agricultural College at Amherst, Massachusetts, the sum of.....dollars.

Signed....."

MASSACHUSETTS
AGRICULTURAL EXPERIMENT STATION

BULLETIN No. 271 FEBRUARY, 1931

Annual Report

For the Fiscal Year Ending Nov. 30, 1930

The main purpose of this report is to provide an opportunity for presenting in published form, recent results from experimentation in fields or on projects where progress has not been such as to justify the general and definite conclusions necessary to meet the requirements of bulletin or journal.

Requests for Bulletins should be addressed to the

AGRICULTURAL EXPERIMENT STATION,
AMHERST, MASS.

MASSACHUSETTS AGRICULTURAL EXPERIMENT STATION

Trustee Committee on Experiment Station

	Term Expires
Preston, Charles H., Hathorne, *Chairman*	1932
Frost, Harold L., Arlington	1931
Richardson, Carlton D., West Brookfield	1932
Whitmore, Philip F., Sunderland	1934
Russell, Howard S., Waltham	1936
Gilbert, Arthur W., Belmont, *State Commissioner of Agriculture, ex officio*	

Experiment Station Staff, December, 1930

Roscoe W. Thatcher, President of the College

Sievers, Fred J., Director — Kenney, Fred C., Treasurer

Lindsey, Joseph B., Vice-Director — Church, Lucia G., Secretary

Gaskill, Edwin F., Assistant to the Director

*Beaumont, Arthur B., Agronomy
*Bourne, Arthur I., Entomology
*Cance, Alexander E., Agricultural Economics
*Chenoweth, Walter W., Horticultural Manufactures
Doran, William L., Botany
Fellers, Carl R., Horticultural Manufactures
*Foord, James A., Farm Management
*Frandsen, Julius H., Dairy Industry
†*Franklin, Henry J., Cranberries
*Gage, G. Edward, Bacteriology
*Gaskill, Edwin F., Station Service
*Graham, John C., Poultry Husbandry
*Gunness, Christian I., Agricultural Engineering and Meteorology
*Haskins, Henri D., Fertilizer Law
Hays, Frank A., Poultry Husbandry
Holland, Edward B., Plant and Animal Chemistry
‡*Koon, Ray M., Vegetable Gardening
*Lentz, John B., Veterinary Science
Lindsey, Adrian H., Agricultural Economics
*Lindsey, Joseph B., Plant and Animal Chemistry
Morse, Fred W., Plant and Animal Chemistry
*Osmun, A. Vincent, Botany
*Sears, Fred C., Pomology
Shaw, Jacob K., Pomology
*Smith, Philip H., Feed, Dairy and Seed Laws
*Thayer, Clark L., Floriculture
Van Meter, Ralph A., Pomology
Van Roekel, Henry, Veterinary Science
*Waugh, Frank A., Horticulture
*Wood, Basil B., Library

Archibald, John G., Plant and Animal Chemistry
Bailey, John S., Pomology
Bullis, Kenneth I., Veterinary Science
*Davies, Esther, Home Economics Research
DeRose, H. Robert, Fertilizer Law
Dunlap, Glen L., Veterinary Science
‡Dempsey, Paul W., Vegetable Gardening
Flint, Oliver S., Veterinary Science
France, Ralph L., Bacteriology
Fuller, James E., Bacteriology
Gibbs, Charles S., Veterinary Science
‡Guba, Emil F., Botany
Jefferson, Lorian P., Agricultural Economics
Jones, Carleton P., Plant and Animal Chemistry
Jones, Linus H., Botany
Larsinos, George J., Fertilizer Law
McLaughlin, Frederick A., Seed Law
Mighell, Ronald L., Farm Management
Rozman, David, Agricultural Economics
Spelman, Albert F., Feed Law
‡Whitcomb, Warren D., Entomology
‡White, Harold E., Floriculture
Wright, Kenneth E., Dairy Industry

Allen, Harry L., Plant and Animal Chemistry
Ball, Alyn S., Botany
Bennett, Emmett, Plant and Animal Chemistry
Clague, John A., Horticultural Manufactures
Clarke, Miriam K., Veterinary Science
Cleveland, Maurice M., Horticultural Manufactures
Cutler, Walter L., Pomology
Donley, J. Elizabeth, Agricultural Economics
‡Donnelly, Edward B., Floriculture
*Felton, F. Ethel, Editor
Foley, Richard C., Animal Husbandry
Howard, James T., Feed, Fertilizer and Dairy Laws
Hughes, Mary C., Pomology
Jones, William L., Agronomy
Merriam, Oreana A., Home Economics Research
Miner, Gladys I., Botany
Mueller, William S., Dairy Industry
Parkinson, Leonard R., Plant and Animal Chemistry
Sanborn, Ruby, Poultry Husbandry
Sherburne, Ruth E., Agricultural Economics
Snell, Moses E., Agronomy
Stuart, William M., Jr., Agronomy
Voorneveld, Madaline, Home Economics Research
Washburn, Doris E., Farm Management
‡Wilson, Harold A., Farm Management

* In Charge † At East Wareham ‡ At Waltham

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ANNUAL REPORT OF THE MASSACHUSETTS AGRICULTURAL EXPERIMENT STATION—1930

INTRODUCTION

F. J. Sievers, Director

During the past year there have been a few very significant changes in the organization of the Experiment Station and also in the type of service rendered.

What was formerly known as the Market Garden Field Station, located at Waltham, was organized primarily to support a type of research and demonstration of special value to the trucking industry, already well established in the eastern part of the State and particularly in the vicinity of Boston. Consistent with this service the work was directed by the department of vegetable gardening of the Agricultural College. In the beginning its services were largely of an extension and demonstrational nature with very little emphasis on investigation or research. With the demands for more specific fundamental information, research men in plant pathology, entomology, genetics, and floriculture were soon added to the staff with the result that the original system of administration was found not only cumbersome but no longer adequate. To correct this situation and to bring this unit of the Institution into closer and more logical relationship with the central administration, the Board of Trustees, at its June meeting, decided to change the name to the Waltham Field Station and place it under the direction of the Experiment Station at Amherst with R. M. Koon, Research Professor of Vegetable Gardening, directly in charge. This branch Station now holds the same relationship to the main Experiment Station as does the Cranberry Station at East Wareham, both of which are now organized and conducted to give major consideration to research. Conditions under the reorganization should be very nearly ideal because an opportunity is thereby afforded for four departments in the Institution, viz., botany, entomology, floriculture, and olericulture, to plan and direct certain investigations at the Field Station in Waltham through representatives of the respective departments who are in residence there.

The demands for increased service through the Field Station have been pressing for several years, and at the last legislative session these took a very definite form in the introduction and passage of a special bill providing for a liberal increase in equipment and financial support for investigations in floriculture. This new work is already well under way and it is hoped that the results will be of a nature to justify the faith placed in the Experiment Station service by those who were responsible in urging the necessary legislation.

At the Cranberry Station it has been possible to give special and increased consideration to matters influencing quality of product because of very close and satisfactory cooperation with Federal agencies. There

are evidences that here, too, as at the Waltham Field Station, there is a gradual trend toward research from work of a largely demonstrational nature.

The added facilities provided with the completion of the well-equipped horticultural manufactures building on the College campus makes possible a high quality of research work in this field. As a result the program of investigation is being gradually enlarged to include products not heretofore studied.

There is also in evidence the development of an interest on the part of commercial agencies to provide the Experiment Station with financial support for research in specific fields. Several cooperative projects supported by funds from this source are already under way. This development up to the present has proved very satisfactory both from the standpoint of the donors and of the public whom we are primarily organized to serve, and it is hoped to encourage these relationships.

The reorganization of the Graduate School in July, 1930, whereby its administration was transferred to the Director of the Experiment Station, should prove of advantage to both of these units which are organized so directly around a research program. Many phases of regularly approved Experiment Station projects lend themselves very effectively to graduate study, and already several students are working on such assignments for credit toward an advanced degree.

With the strengthening of the Extension Service program, many of the activities previously considered essential in the Experiment Station are gradually requiring less emphasis. This is evidenced especially in field work as conducted by the departments of agronomy and pomology. Many so-called investigations, which in reality are demonstrations, are being taken over by the Extension Service, where they rightly belong, thus providing the research men in these fields time for better controlled and more basic studies. Changes in this direction should of necessity be slow, but present trends indicate that they are also sure—a very encouraging sign of progress.

DEPARTMENT OF AGRICULTURAL ECONOMICS

Alexander E. Cance in Charge

Consumer Demand for Eggs. (Lorian P. Jefferson). The collection of data for this study is largely completed. General tabulations have been made but no attempt to draw conclusions as yet. The study looks to a determination of the demand for different grades of eggs, the proportion of grades handled, the opportunity for the local producer in local markets, and the differences between demand in different markets.

The Economic Worth to Growers of Different Varieties of Apples. (Lorian P. Jefferson). This study is still under way, having been planned to cover at least five years. Obviously no conclusions can be drawn until the end of the period.

Competition Between Apples and Other Fruits. (Lorian P. Jefferson). The study, involving many statistical correlations, actually reveals little direct competition between apples and any other of the most common fruits.

However, it may be questioned whether the statistical data tell the whole story. While statistics show almost no influence of the supply and price of oranges on the price of apples, it is true that the per capita consumption of apples is declining. Apparently, also, the type of demand is changing, and apples are being used for different purposes since the orange has become so largely the fruit on our breakfast tables.

The price variations of Baldwin apples in Boston are chiefly determined by three factors not related to other fruits: the size of the United States apple crop, the size of the New England crop, and the general level of prices. Of these the size of the United States crop is the most important factor.

The price of McIntosh apples is, however, little influenced by the total volume of apples on the market or by New England production, but is markedly affected by the general level and trend of prices. Correlations of supply and price of various other fruits with the price of McIntosh indicate that no one of these has any noticeable influence.

Part-Time Farming. (David Rozman) The project on part-time farming has been completed and the material published as Bulletin 266.

Recreational and Forestry Uses of Land. (David Rozman). Data on land values, taxation, and area held by non-residents were secured from the assessors' books in 71 towns, representing 25 per cent of all towns in the State with a population of less than 10,000. This material is now being tabulated and analyzed as to its bearing on the problems of land utilization.

Detailed information on land utilization was obtained in several towns through personal interviews with assessors, town clerks, real-estate men, and other local people. No definite conclusions from this study will be available until completion of the field work during the next spring.

Factors Affecting Egg Prices. (A. H. Lindsey). Wholesale price quotations on the Boston market were used for the basic material of this study. Lack of purchasing power in 1929 and 1930 caused the trend of egg prices, which was already downward, to turn even more sharply downward. The improvement in quality of western eggs has not seriously affected the favorable differential which has existed between prices of western and nearby eggs.

A formula for forecasting peak prices of eggs in November from data on June first has been worked out with an accuracy in results of within two cents, two years out of three. The average price of eggs in April may also be forecast from October—December data with an accuracy of within 2.8 cents in two-thirds of the cases.

The Relation of Quality Factors to Price of Eggs. (A. H. Lindsey). Quality factors used were air cell, weight, condition of yolk, condition of white. Prices were found by purchase of eggs from retail stores in Boston. Three periods were studied—April, August, and November. Weight was of much greater significance in April than in November. Air space was most important in November. Condition of yolk was most important in April. The combined effect of all quality factors on price was of greatest importance in August.

Competitive Factors Influencing the Supply of Market Milk and Cream. (A. H. Lindsey). A study of the Worcester milk shed was made from

records of the City Inspector's Office. Changes in price and inspection had very little influence in changing the milk-shed area. More milk is being produced at great distances from the city and less in the vicinity of the city. The consumption of quality milk is increasing.

Analysis of Market Prices for Massachusetts Vegetables. (H. B. Rowe). A preliminary analysis has been made of the price and supply data which were tabulated last year for ten of the more important vegetables on the Boston market, and a more complete study of asparagus prices has been practically completed. The preliminary analyses indicate that valuable results may be expected for all but two of the ten crops. The asparagus study has furnished quantitative measurements of the relationship between local prices and the two most important price factors, local supply and shipped-in supply, during the period just preceding the local marketing season. Knowledge of these relationships makes possible the interpretation of outlook for local producers, with a degree of accuracy and reliability which could not be attained heretofore.

DEPARTMENT OF AGRICULTURAL ENGINEERING

C. I. Gunness in Charge

Investigation of Apple Storages. (C. I. Gunness). The investigation of mechanically refrigerated storages has been carried on this year along two distinct lines. The phase pertaining to the temperature requirements for satisfactory storage has been continued in cooperation with the Department of Pomology. The results of two years' observation will be available at the end of the present storage season.

The study of another phase of the storage problem was made possible this year through the fact that three fruit growers installed mechanical refrigeration on their farms, and careful observation has been made of the operation of these storages. Different types of equipment have been installed in these various storages, and it has been possible to observe the effect of various types of equipment on the stored fruit. Data on the cost of operation of the various storages are being collected.

Fertilizer Distributors. (C. I. Gunness). Very little work has been done on this project during the present year. It is hoped that more time can be given to this project during 1931.

Test of Low-Lift Pumps. (C. I. Gunness). During the past summer a testing plant was built at the Cranberry Station at East Wareham for the testing of low-lift pumps. This was completed in August, and one pump was tested. The publication of the results will be delayed until additional pumps can be tested.

DEPARTMENT OF AGRONOMY

A. B. Beaumont in Charge

Nitrogen Assimilation by Grasses and Clovers. (A. B. Beaumont and G. Rohde). Additional evidence obtained from solution cultures showed that blue grass, timothy, redtop, English rye grass, and red and alsike clovers assimilated nitrate nitrogen better than that from ammonium sulfate and urea, as judged by growth. In the early stages there was little difference in the growth of the several grasses, but differences appeared in the later stages. With the clovers, the differences due to form of nitrogen appeared earlier and were more pronounced.

Ecological Study of Pasture Vegetation. (A. B. Beaumont, E. F. Gaskill and R. W. Donaldson). The old experiments have been continued and new ones added for the purpose of comparing different carriers of nitrogen and different amounts of lime and other calcium compounds. Results of this year indicate that very little effect may be expected from minerals (lime, phosphoric acid and potash) the same year they are applied as a top-dressing, whereas all forms of nitrogen used are more or less effective the first year. Similar evidence regarding response to minerals and a nitrogen fertilizer (Chilean nitrate of soda) were obtained from ten outlying fields in Worcester County.

Additional Pasture Experiments. (A. B. Beaumont, R. E. Stitt and R. C. Foley). In a palatability test it was found that two Holstein cows chose pasturage as follows: (1), white clover; (2), timothy; (3), redtop; (4), blue grass. There was little if any effect of different fertilizer treatments on palatability although there was some indication that grass from plots which received the largest amount of nitrogen was preferred by the animals. On certain of the Hohenheim plots it was likewise observed that seedings containing a high proportion of timothy were preferred by dairy animals.

In an experiment in which two carriers of nitrogen were used as top-dressing for a mossy pasture, it was observed that Chilean nitrate of soda acted as a mild toxin for moss. To a considerable extent moss was permanently killed without injuring the desirable vegetation.

Legume Veriety Tests. (A. B. Beaumont and R. E. Stitt, cooperating with E. A. Hollowell, Bur. of Plant Indus. U. S. D. A.).

Alfalfa.—Test No. 1 was brought to a close on account of weediness, and the field plowed after spring data on stand were obtained. These data were in substantial agreement with those reported last year. The experiment has shown that for a period of at least three years the common varieties of alfalfa coming from such states as Utah, Kansas, and the Dakotas may be expected to be in the same class as Grimm and other variegated varieties as respects winter-hardiness. Test No. 2 also was terminated on account of weediness (mainly grasses). This test has given data on winter-hardiness similar to those of Test No. 1, but covering more varieties. Ludak, Turkestan and Arizona were definitely poor in stand after two winters; California, South African, and Colorado were good; and Grimm, Ontario, Hungarian, Dakota Common, Hardigan, Disco, New Mexico, Italian, Utah, Kansas, and French were the best.

Further, this test has demonstrated that it is unwise to seed alfalfa on sod land in Massachusetts without the intervention of at least one year of tilled crop or fallow to kill troublesome weeds, especially the grasses. From Test No. 3, seeded in 1929, data on stand and yield were obtained this year. Yields per acre for two cuttings, one year after seeding were:

4-5 tons; Ontario, Hardigan, Dakota Common, Hungarian, Italian.
3-4 tons: Dakota 12, Disco, Utah, Argentine, Nebraska, Turkestan, Kansas, New Mexico, Ladak.
2-3 tons: Arizona, South African.
1-2 tons: Hairy Peruvian.

Soy beans.—Of 20 varieties of soy beans, the following 10 yielded the most hay in decreasing order: Dunfield, Manchu, Habaro, Mansoy, Virginia, Medium Green, Harbinsoy, George Washington, Illini, Pinpu. Seven of these were among the highest yielding 10 varieties of last year.

Field Peas.—Of 5 varieties tested, Chang led in yield of hay, followed by Golden Vine, O. A. C. 181, Wisconsin Common, and Multiplier, in order.

Vetch.—Spring sown vetch varieties yielded hay in the following order: Oregon Pearl, Oregon Common, Smooth (15851), Hungarian, Hairy (15760).

None of these annual legumes—soy beans, field peas, vetch—with only one cutting, yielded as much hay as well-adapted alfalfa varieties with two or more cuttings a season according to these tests. Therefore, it appears that such annual legumes should be considered mainly as emergency substitutes for the higher-yielding alfalfa and clovers.

Method of Applying Fertilizer to Corn. (A. B. Beaumont, E. F. Gaskill and R. E. Stitt). This is the third consecutive year that a field test of methods of applying fertilizer to corn has been made. The work was done according to a plan for cooperative work sponsored by a joint committee representing the American Society of Agronomy, National Society of Farm Equipment Manufacturers, American Society of Agricultural Engineers, and National Fertilizer Association. The results of this year are in general agreement with those of preceding years; namely, that fertilizer applied in the hill gives better results than the same, and in some cases, larger amounts broadcast. Fertilizer applied in the hill at the rate of 500 pounds was superior to 500 pounds or 1000 pounds broadcast.

Field Experiments with Onions. (A. B. Beaumont and M. E. Snell). Most of these experiments were redirected last spring in the light of results of the last five years. The crop was started from sets instead of seeds as in previous years. Cover crops were omitted this year, the comparison of muriate and sulfate of potash was dropped, and certain changes were made in the study of fertilizer ratios.

In the lime series, where lime was applied in 1925, there was a progressive increase in yield from applications of 2 up to 6 tons of limestone per acre. In two other series one of which received lime in 1925, the other in 1928, the yield from the later application was superior to that from the earlier, indicating that when lime is used in moderate amounts, the applications should be more frequent. Experiments on the substitution of superphosphate for a part of the lime gave results which indicate that superphosphate can take the place of little if any of the required lime, and at present prices of these materials there would be no economy in the sub-

stitution. All the experiments thus far indicate that lime is indispensable for successful onion production on the soils of the Connecticut Valley.

In the old fertilizer ratio series, the 4-12-8, which has led in former years, was inferior to the 4-8-4 and about equal to the 4-8-8. (Figures refer to percentages of NH_3 (old basis), P_2O_5, and K_2O, respectively.) The highest yield was from the 4-8-4 with later side dressing of nitrate of soda equivalent to a 2-0-0, and the lowest from 2-12-8. It is quite possible that the substitution of sets for seed influenced the effect of fertilizers. The 4-7-4 with a side dressing of fish (2-1-0) gave a low yield. These results with additional nitrogen as side dressing are similar to those of last year, but cannot be explained in the same way; last year was unusually dry, while in 1930 the rainfall during the growing period of the onions (sets) was slightly above normal. In the lime series the 4-12-8 was superior to the 4-8-4, and in the old cover crop series the 4-12-8 was superior to the 6-8-8. Considering the results of this experiment for the six years of its duration, it would seem that for land which has not been intensively fertilized for several years previously, a fertilizer high in prosphoric acid and potash, something like a 4-12-8, is needed for at least the first several years of onion growing. Fertilizer has been applied at the rate of 2500 pounds per acre, a comparatively high rate, and it is quite probable that a cumulative effect of previous years is beginning to manifest itself.

A field experiment with onion sets of three size groups demonstrated the superiority of sets of medium size. Sets from one-half to three-fourths inch in diameter yielded almost twice as much as those one-fourth to one-half inch, and slightly more than those three-fourths to one inch. The medium group threw less than 1 per cent seed stalks, the large sizes 72.9 per cent, and the smallest none. The largest sets produced 33.0 per cent multiple bulbs, medium sets 1.4 per cent, and smallest sets 0.12 per cent. About three times as many bushels were required to plant an acre with large sets as with medium-sized sets. Altogether, the results were strikingly in favor of medium sets.

Onion breeding work was continued on lines previously described.

Nitrogen Assimilation by Tobacco. (A. B. Beaumont and G. Rohde). Further evidence has been secured from solution cultures which supports statements made in the last report that nitrogen in the form of nitrates is better assimilated than in the form of ammonia, urea, and certain organic forms. This nutritive relation prevails when the entire growing period of the plant is considered, although there appear to be stages of growth when ammonia is assimilated as well as nitrate, if not better.

Field Experiments with Tobacco. (A. B. Beaumont and M. E. Snell). 1930 has been the best year for the growth of tobacco since the field experiments were started seven years ago, with the best plots producing slightly more than 1 ton of cured leaf per acre, and all plots averaging around 1800 pounds per acre. The highest yield, averaging 1998 pounds per acre, was from a series of 10 plots which received 2625 pounds of tobacco fertilizer analyzing 4.1 per cent N, 4.0 per cent P_2O_5, and 5.0 per cent K_2O, and 10 tons of manure. Five plots which had a cover crop of redtop were next with an average yield of 1936 pounds, followed by those which had timothy and rye as cover crops. As in previous years, tobacco yields were poorest in the animal husbandry rotation (corn, timothy or clover, and tobacco), yields being 1201 pounds after timothy and 1326

after clover. It has now been established that this particular rotation is unsuitable for tobacco, producing symptoms of a malady known as brown root-rot. It remains to determine the underlying causes of the effect, and efforts are now directed particularly to that study. With that in mind the field experiments were redirected in the spring of 1930, the cash-crop rotation being replaced by a duplication of the animal husbandry rotation, and the so-called "criss-cross" rotations dropped.

In an experiment involving different quantities of nitrogen, phosphoric acid and potash remaining constant, 164.5 pounds nitrogen per acre (200 pounds ammonia) gave the highest yield, followed in order by 205.6, 123.4 and 61.7 pounds nitrogen. From this and previous years it seems that for Massachusetts conditions 100 to 150 pounds of nitrogen are necessary for maximum yields of tobacco.

In a further comparison of different carriers of nitrogen, ammonium sulfate produced more tobacco than sodium nitrate, cottonseed meal or the regular mixture containing several forms of nitrogen. Furthermore, and of particular interest in view of results of previous years and other experiments, yields were slightly greater from plots which had one year of timothy preceding tobacco than from the plots which had tobacco the previous year. However, all yields were good.

The following miscellaneous tests were made on a small scale, too small to give more than indicative results:

(1) Both Nitrophoska (15-30-15) and regular tobacco fertilizer containing considerable cottonseed meal, plus magnesium sulfate, failed to produce normal crops of tobacco without lime, when used on a very acid soil (pH about 4.5).

(2) With potash omitted from the regular tobacco fertilizer, but supplied in ground tobacco stems, a good yield of tobacco was obtained.

(3) Colloidal phosphate at rates of 1000 and 2000 pounds per acre, in addition to the regular fertilizer mixture, slightly increased yield.

(4) Milorganite, an organic fertilizer made from processed sewage, proved a good substitute for the more expensive cottonseed meal, producing 1801 pounds per acre. It remains to be seen what the quality of the crop will be.

(5) Fertilizer applied in the row produced slightly more than an equal amount applied broadcast. One-half the standard ration in the row produced 1663 pounds, which compares with 1859 pounds from a full ration broadcast. This is the first year of this experiment and results are only indicative; but in view of results from a similar experiment with corn, it is worth repeating.

Magnesium Requirements of Crops. (A. B. Beaumont and M. E. Snell). This investigation was continued in pot and field experiments according to plans made by J. P. Jones. No outstanding symptoms or depression of yields were obtained in either case. It is now suspected that, except in cases of exceptional deficiency in soil magnesium, plants will hardly be affected in dry years or the next year or two following dry years, owing to the supply of native magnesium through the natural weathering processes. It is planned to continue this investigation.

DEPARTMENT OF BACTERIOLOGY AND PHYSIOLOGY

G. E. Gage in Charge

Nitrogen-Fixation in Relation to Leguminous Crops. (James E. Fuller). Previous work on phases of this subject has been reported during the past year in *Soil Science*, Volume 30, July, 1930, under title of "Nitrogen-Fixation in Field Soil under Different Conditions of Cropping and Soil Treatment." During the course of this investigation the data indicated the possibility that the lime applied may have been responsible for the variations in the amount of nitrogen fixed by the soil from the different plots of the field. The hydrogen-ion concentration of the soil from the various plots showed no marked variation, although the quantity of lime applied varied widely. Therefore, there is a possibility that lime may have some relation to Azotobacter metabolism other than the neutralization of acidity.

Synthetic media have been studied in the laboratory during the year to ascertain the influence of different calcium compounds on the amount of nitrogen fixed by the different strains of Azotobacter. These experiments are being repeated. Plant-house experiments are being conducted in which soil is treated with the calcium compounds employed in the synthetic media, these compounds including salts varying in their ability to neutralize acids. The purpose of the investigation is to study the influence of the calcium in the presence and absence of combined nitrogen.

Another phase of this project has had to do with distribution of cellulose-decomposing activity in the soil of the experimental field. The data at present appear to correlate the nitrogen-fixing activity of the soil from the different plots of the field.

Besides work on this project, a cooperative experiment has been in progress with the Department of Botany. This has had to do with the effect of temperature on the utilization of nitrates by cellulose-decomposing organisms. The data obtained thus far indicate that from the laboratory standpoint soil known to contain active cellulose-decomposing organisms will bring about decomposition of cellulose within a certain space of time. Decomposition was less active at temperatures below 15° C. Data from the pot experiments will be found in the report of the Department of Botany.

Laboratory Service. (Ralph L. France). During the past year the Laboratory Service has given assistance to local milk inspectors and milk dealers throughout the Connecticut Valley. Towns and a few cities have called upon the laboratory for monthly tests of all milk sold within their boundaries. This phase of service has grown into a health control service not only through the medium of laboratory tests but also through information given in personal interviews with dealers and inspectors and by inspections of dairy barns.

Samples of water from private supplies from many parts of the State have been submitted for bacteriological analysis to establish their purity for drinking purposes. Fifty per cent of all the samples analyzed during the year were unsafe for human consumption. This condition shows no great improvement over previous years, and indicates that there is need for active education concerning the location and construction of rural

water supplies. It might be of value, if the laboratory appropriation could be increased sufficiently to finance the undertaking, to make sanitary inspection of the water supply and environment in some of these districts having unsafe water.

The legume culture collection has been kept intact and propagated as in past years, for the purpose of distributing to farmers needing this material for legume inoculation. Nearly all cultures furnished were for inoculating alfalfa.

The miscellaneous examinations made during the year include examinations of milk for garget, streptococci and other organisms causing inflammation of the udder, chemical analyses of milk, and examination of food products for organisms causing unnatural spoilage.

The Indol Tolerance of the Colon-Aerogenes Group of Bacteria as a Possible Means of Differentiating Fecal and Non-Fecal Strains Occurring in Drinking Water Supplies. (Ralph L. France). The work to date indicates that in order to establish a more uniform set of results for the determination of the possible use of the indol tolerance as a test, it is necessary to make some changes in methods and a more complete study of the biochemical activities of the various strains. With these studies followed through, it is anticipated that the difficulties already expressed may be eliminated, making it possible to obtain more consistent results.

DEPARTMENT OF BOTANY

A. Vincent Osmun in charge

Tobacco Black Root-Rot. (W. L. Doran). Soil in plots last limed in 1923 still had pH values favorable to infection by Thielavia in 1930. Neither alfalfa nor timothy was more effective than tobacco in lowering the pH value of over-limed soil. Soil acidity of limed plots was increased somewhat even four years after the application of sulfur. As in previous years, there was less black root-rot in limed plots to which sulfur or acids were applied in 1926 and 1927 than in limed plots not acidified.

There was not much, if any, less black root-rot of tobacco following the hay crops than in plots of continuous tobacco.

Yields of tobacco in plots limed were 27 per cent less than yields in plots not limed. Loss caused by lime applied in 1923, has been decreasing since 1925. Increased yields in limed plots resulting from the application of acids or sulfur were less in 1930 than in earlier years.

The application of sulfur to a field in which the soil had an initial pH value of 7.1 lowered the pH value to 6.5, but this was not enough to affect black root-rot or growth of tobacco.

An application of orthophosphoric acid lowered a soil pH value from 5.9 to 5.0, but black root-rot was nevertheless severe. It is apparent that other factors than or in addition to the hydrogen ion concentration of the soil are concerned.

Tobacco Brown Root-Rot. (W. L. Doran). In the second or third year of tobacco following alfalfa, timothy or alsike clover, there was little and in most cases no brown root-rot. The brown root-rot effect of these hay

crops on the tobacco which followed them disappeared after the first year or two of tobacco.

Assuming, for hypothetical purposes, that brown root-rot is associated with certain soil microorganisms, which may result in a deficiency of nitrogen and (or) the formation of toxic substances in the soil, it is conceivably possible that certain inorganic salts applied to soil might inhibit such microorganisms or might inactivate, chemically, such toxic substances. Copper oxide, copper sulfate, copper acetate, lead sulfate, or lead acetate were applied in varying amounts to brown root-rot soil (timothy sod), and in it tobacco was grown. These salts of copper and lead, in the amounts used, were all somewhat toxic to tobacco plants.

Since brown root-rot is worse in some soils than in others, under the same cropping system, work is now in progress with the object of finding some of the relations between brown root-rot and certain characteristics of the soil, including total nitrogen, P_2O_5, organic matter, soluble iron and aluminum, mechanical condition, and water-holding capacity. The chemical work involved is being done in the Fertilizer Control Laboratory, and tobacco is being grown in all (12) soils.

A Seedbed and Field Survey of Tobacco Diseases in Massachusetts. (W. H. Davis, O. C. Boyd, and W. L. Doran). In a tobacco disease survey of the State, 50 seedbeds and about 100 representative fields were inspected. The results may be briefly summarized as follows:

Seedbed Survey

(1) The soil was sterilized in 25 per cent of the seedbeds.

(2) Twenty per cent of the seedbeds were sprayed or dusted; this practice was followed by nearly everyone planting ten acres or more.

(3) Growers who sterilized their seedbeds were rewarded with superior plants and fewer losses in the crop from wildfire, mosaic and other diseases.

(4) In one instance where a few plants from a bed infected with wildfire were transplanted to a fourteen-acre field, 30 per cent of the plants in the field became infected, causing appreciable loss at harvest.

(5) Growers who have their seed "blown" believed it to be a good investment, permitting use of less seed and insuring better and earlier plants.

Field Survey

(1) Wildfire was found in all fields inspected, except ten, with losses from a trace to 20 per cent.

(2) Angular leaf-spot caused by a bacterium (*B. angulatum*) and new to most of the growers was located throughout the area.

(3) Mosaic or calico was the most prevalent disease, as it occurred in nearly every field.

Onion Diseases and Use of Fungicides on Onions. (W. L. Doran). In cooperation with A. I. Bourne, systematic observations were again made in many onion fields, and for the second year spraying and dusting experiments were conducted. There was neither blast nor mildew here in 1930.

Yields were not affected by copper lime dust; but were increased 13 or 16 per cent by Bordeaux mixture 4-4-50, applied 4 or 6 times, respectively, and 17 or 24 per cent by Bordeaux mixture 8-4-50, applied 3 times or twice, respectively.

Onion Blast (L. H. Jones). By artificially controlling the environment of growing onions, it was possible to produce an injury to the plants resembling blast. Reduced light, high relative humidity, and a wet soil for a period of ten days was sufficient to make the plants blast when exposed for a few hours to intense sunshine and an atmosphere of low relative humidity. Absence of blast in the field this year precluded the possibility of comparison with that condition as it occurs naturally.

Eggplant Wilt. (E. F. Guba, Waltham). Since the last report, study has been confined to the pH relations of the causal organism and host. On slides in Petri dishes aluminum sulfate in 1-100 to 1-500 dilutions, inoculated sulfur, and monohydrated copper-lime dust (20-80) destroyed the viability of the spores. Nutrient media acidulated with sulfuric acid completely inhibited growth of the pathogene at pH 3.7, and the rate of growth increased in proportion to an increase in the pH value of the growing medium. Retardation of growth occurred below pH 4.5. However, the increase in growth of the pathogene due to but slight decreases in acidity between pH 4.0 and 4.5 was significant.

Aluminum sulfate and inoculated sulfur were compared with respect to their effect upon the growth of eggplants and the control of the disease. Wooden boxes holding four gallons of soil were used and the acidifying agents were added in increasing quantities. Inoculated sulfur produced a rapid increase in acidity, while at least three times as much aluminum sulfate was required to obtain the same effect. With aluminum sulfate, a range of pH 4.7-5.0 showed no effect upon the growth of eggplants. Infection occurred at pH 5.0 and higher. Below pH 4.7 growth became poorer as the pH value of the soil decreased. With inoculated sulfur, all of the plants were infected at a soil pH of 4.3, and one-third of them at pH 4.0. At pH 4.0 growth was fair, and at pH 3.5-3.6 the plants were killed.

The effect of field applications of chemicals on the control of the disease and the growth of the host was studied. The plants were grown in soil sterilized with formaldehyde, and the field to which the chemicals were applied had been used for eggplants for four years in succession. The results revealed the failure of inoculated sulfur and aluminum sulfate to control the disease when applied at a rate in excess of the tolerance of the host. No results were secured which could be construed as a basis for suggesting acidification of infested soil as a method of controlling eggplant wilt. In the experiment reported, eggplants on land in sod for five years gave the best growth and the best yield in spite of the high percentage of infection. The existing practice of using old sod for eggplants remains the only reliable and practical method of control.

Cucumber Downy Mildew. (W. L. Doran). The weather of the season seems to have little relation to the date of the first appearance of this disease in the field. In six consecutive years (1925-1930), downy mildew has always appeared here within the first two weeks of August.

Bodies resembling oospores have been found, but attempts to germinate them or cause infection with them were without result. The means of overwintering of *Peronoplasmopara cubensis,* therefore, remains undertermined.

It was found that conidia produced in any dewy night do not live after the sun dries the dew in the morning. Infection in the absence of rain, there-

fore, must occur the same night or the same morning as that in which sporulation has brought the infecting conidia into existence.

Greenhouse cucumbers were injured by dusting with sulfur but not by spraying with Bordeaux mixture 1-1-50, 1-5-50, 2-2-50, 2-10-50, 4-4-50, 3-10-50, or 4-0.8-50, nor by copper acetate, Pickering spray, or milk of lime.

Cucumbers which had been sprayed, the day before, with Bordeaux mixture 1-1-50, 2-2-50, 2-10-50, 3-3-50, and 3-10-50 were inoculated with a suspension of the conidia of *P. cubensis* in water. There was no infection of any of the plants so treated, although every leaf of check (unsprayed) plants became infected. In the greenhouse, Bordeaux mixture, 1-1-50 is probably adequate in preventing infection of cucumbers by this fungus.

Strawberry Gold Disease 1930. (E. F. Guba, Waltham). Experiments are under way to determine the nature and manner of spread of the disease. The possible relation of insects to infection is being determined by W. D. Whitcomb. The value of roguing and the selection of healthy plants for the succeeding planting are being considered as means of control. Data from the experiments undertaken will be available in 1931.

Tomato Leaf-Mold. (E. F. Guba, Waltham). Work on this project during the year has been confined to demonstrations of the control of the disease through air management based on knowledge of the temperature and humidity relations of the fungus. Adequate air circulation to prevent excessive temperatures and to insure rapid removal of water of transpiration from the leaf surfaces is essential to the control of the disease. From June to September, inclusive, when heating is not practiced, inside conditions should parallel outside conditions as nearly as possible; likewise during warm intervals in May and October, and when the outside temperature does not drop below 50°F. With a daily minimum of less than 50° F. outside, heat to provide an inside temperature of 60°-65° F. with a little ventilation is important. After the middle of November ventilation is not necessary so long as the inside temperature is less than 80° F.

Old-type greenhouses often lack adequate means of ventilation. Experiments have shown that for these houses especially, and for modern types where hand control is not efficient, automatic control of humidity will remove the disease as a factor so far as it influences the yield. The system involves a series of exhaust fans and pipe heat, the movement of the former and the flow of the latter called for independently or in unison by a hygrostat, set (for tomato leaf-mold) to demand heat and exhaust air when a maximum relative humidity of 80 per cent is reached. A low thermostat set at 60° F. guarantees the minimum growing temperature, and a high thermostat set at 70° F. determines the range of temperature within which heat may be expected to operate the hygrostat for its control of the humidity. Above this range the humidity is controlled by the exhaustion of air only. Ventilation was necessary only as the inside temperature rose above 70° F. In the fall and winter of 1929-30, automatic humidity control gave 17 per cent less infected foliage than automatic temperature control, and in the fall and winter of 1930-31 (up to December 1) 10 per cent less than automatic temperature control. Since the comparison was made with conditions which were subjected to careful hand control except for temperature which was automatically regulated, and in a greenhouse with ample ventilating area, the small difference in favor of automatic humidity control is significant.

Eradication of Nematodes in Greenhouse Soils. (L. H. Jones). A mixture of equal parts by weight of calcium cyanide (Cyanogas) with paradichlorobenzene, incorporated in the soil of a ground bed in two applications with an interval of seven days, successfully eradicated nematodes. Each application was at the rate of 2400 pounds per acre. Twenty-nine days after the second application, tomatoes were planted in the bed. The first crop was adversely affected by the paradichlorobenzene. The second crop was excellent, both in foliage growth and production. The bed has remained free from nematodes for more than a year while beds on either side have been severely infested. Though this treatment is not practical, the results seem to promise some measure of success for the effort to apply the principle of dry chemical applications to the eradication of nematodes in the soil.

Ridding Soil of the Narcissus Nematode. (L. H. Jones). The narcissus nematode (*Tylenchus dipsaci*) is quite distinct from the parasitic species found in greenhouse soils. The former has been eradicated by treatments that failed entirely when used against the greenhouse nematode. Soil infested with the narcissus nematode was freed of this organism by each of the following treatments: steam in one application, chloropicrin (tear gas) in one treatment, Cyanogas in two treatments, and a combination of Cyanogas and paradichlorobenzene in one treatment. Narcissus was grown on the treated soils and the bulbs stored until autumn. Efficacy of the treatments was determied by examination of the bulbs.

Carnation Blight. (E. F. Guba, Waltham). The causal fungus (*Alternaria dianthi* S. & H.) does not survive the second winter in the field, indicating the importance of a two-year rotation. Commercial varieties show different degrees of susceptibility to blight, and the reaction of all types to the disease has been carefully studied. In general, the Matchless and related broad-leaved types are very susceptible.

The early occurrence of the disease is often noted in the propagating house and in the flats, but the value of Bordeaux treatments could not be shown in the absence of disease as a factor where the experiments were conducted in 1930. Injuries to the leaf tissue by red spider, artificially with the needle, and by the knife were shown to favor infection of the leaves. Pruning the cuttings, therefore, increased the danger of infection.

Laboratory experiments with fungicides have demonstrated the superiority of Bordeaux mixture and calcium arsenate sprays in preventing germination of the spores and infection of potted plants. A variety of dust mixtures containing combinations of naphthalene, copper sulfate and calcium arsenate in combination with lime or sulfur as fillers prevented spore germination, but on potted plants the most effective protection against infection was obtained with dust mixtures containing calcium arsenate. Of the dusting mixtures used in the field, calcium arsenate, monohydrated copper sulfate and lime gave the best results; but better control was obtained with copper sprays; e.g., Hammond's copper solution, sal soda Bordeaux and caustic soda Bordeaux. Sal soda Bordeaux proved superior to the other sprays used, but none of the sprays or dusts used in 1930 gave satisfactory control of the disease.

Experiments in progress show that loss from disease after the plants are housed is influenced by the prevalence of disease on the plants in the field,

late benching, overhead watering for controlling red spider, over-watering, and high house temperatures. A comparison of overhead watering and naphthalene fumigation for combating red spider showed 27 per cent increase in production of flowers in favor of naphthalene fumigation. The difference is attributed to a higher mortality of plants from Alternaria and Fusarium where water sprays were used for controlling red spider, and to better growth among plants subjected to naphthalene fumigation, resulting from particular house atmospheric conditions attendant with the use of naphthalene.

Plant Diseases not Previously Reported in Massachusetts. (O. C. Boyd and W. H. Davis). Leaf-blight of corn, caused by *Helminthosporium turcicum* Pass., on Golden Bantam, Yellow Dent, Stowell's Evergreen; leaf-spot of *Lupinus polyphyllus,* caused by *Alternaria* sp.; Botrytis wilt of *Lupinus polyphyllus,* caused by *Botrytis vulgaris* Fr.; fruit-drop of grape, caused by *Pestalotia uvicola* Speg., especially severe on Brighton grape; twig-blight of American bladdernut, caused by *Coryneum microstictum* Berk. & Br.; rust of Iris sp., caused by *Puccinia iridis* (DC.) Rabh.; halo blight of Lima bean, caused by *Bacterium medicaginis* (Sack.) EFS. *phaseolicola* Burk.; bacterial leaf-spot of cabbage and cauliflower, caused by *Bacterium maculicolum* McC. (apparently); angular leaf-spot of cucumber, caused by *Bacterium lachrymans* Smith & Bryan; bacterial leaf-speck of muskmellon, undescribed and undetermined; bacterial leaf-spot of summer squash, caused by *Bacterium cucurbitae* Bryan; leaf and fruit-spot of pepper, caused by *Bacterium vesicatorium* E. M. Doidge; bacterial wilt and root-rot of alfalfa, caused by *Aplanobacter insidiosum* McC.; stem-rot of sweet clover, caused by *Corticium vagum* Berk. & Curt.; limb canker of blue spruce, caused by *Cytospora* sp., previously observed for many years but cause not determined; wilt of Japanese barberry, caused by *Verticillium alboatrum* Reinke & Berth.; bud-blight of Gardenia, cause undertermined, associated with the presence of mealybugs and probably bacterial; bacterial blight of soy bean, caused by *Bacterium sojae* Wolf.; leaf-spot of Zinnia (Bacterial; undet.); ring-spot of tobacco (Virus).

Forcing Gladiolus with the Aid of Artificial Light. (L. H. Jones). Gladiolus corms of the variety Crimson Glow, kept in cold storage during the summer, were planted August 21 and September 11. All plants received the normal daylight under glass. Half the plots were curtained off at night and each of these received electric light from a 100 watt bulb. In the planting of August 21 there was an increase of 100 per cent in the number of spikes produced in the artificially lighted plots compared with the non-illuminated plots. In the planting of September 11 fewer spikes were produced in the lighted plots than in the lighted plots of August 21, but no spikes at all were produced in the plots not receiving light. Several of the spikes were in full bloom for Christmas Day. In a later experiment an effort was made to determine whether better results could be obtained from side lighting as distinguished from overhead lighting. Both 100 and 300 watt lights were used. No measurable differences were noted.

The Storage of Gladiolus Corms. (L. H. Jones). Gladiolus corms are harvested in the early autumn and placed in storage until the following spring. Forcing gladiolus in the winter has made it necessary to carry the corms in cold storage during the summer, thus prolonging the dormant period. A cold storage temperature of about 38° F. gave the best results

and usually 100 per cent germination was obtained. Experiments have shown that corms properly stored may be kept in cold storage two years, and positive blossoming results have been obtained after three winters and two summers in storage. The corms should be in shallow trays to permit free circulation of air. An experiment is now under way to determine the maximum time corms may be stored.

Influence of Light Quality on Plant Growth. (A. V. Osmun). The experiment to test the effect of Vita glass on plant growth and development has been continued with somewhat contradictory results. In one test, radishes grown under Vita glass averaged 1.7 grams or 10 per cent less in weight than those grown under ordinary glass; while in another test, the difference was 3.5 grams or 14 per cent in favor of the Vita glass. Lettuce under ordinary glass weighed 3 per cent more than that grown under Vita glass. Compared with previous tests in which radishes under Vita glass increased 71 per cent in weight and lettuce 76 per cent over the plants under ordinary glass, the results are very inconsistent. The tests will be continued.

The Effect of Decomposing Paper on Plant Growth. (L. H. Jones). Nitrogen deficiency in a plant may result from decomposing paper in a soil or from a plant container made of paper in contact with the soil mass. This has been well established by incorporating paper mulch in a soil and also with improperly water-proofed paper flower pots. When paper mulch is incorporated in a soil, nitrogen starvation may ensue unless an available form of nitrogen is supplied to the plant. Using tomato seedlings in four-inch pots with and without paper mulch in the soil, it was noted that all plants made equally good growth for one month. At the end of the second month, the plants in the soil containing no mulch were 33 per cent taller than plants in a soil with mulch, and averaged nine axillary shoots. The plants in the soil containing mulch were without axillary shoots and were more yellow in color, indicating a lack of nitrogen due to decomposing cellulose.

The problem of obtaining good plants from paper pots is not one of soil acidity nor lack of porosity. It has been demonstrated that better plants can be grown in undrained glass containers than in porous clay pots. When plants become yellow in paper pots, they can be made to resume normal growth by an application of sodium nitrate. If the fibers in the paper pot are so protected that decay is impossible, plants equal to those grown in porous clay pots may be grown in these pots.

Chlorosis of Snapdragon caused by an Excess of Lime. (L. H. Jones and H. D. Haskins). Snapdragon plants grown in a greenhouse soil made from a sandy subsoil mixed with manure and lime became very chlorotic. As the new leaves were yellow in the early stage of development the cause seemed related to a deficiency of iron in the plant. When tested for reaction, the soil was decidedly alkaline (pH 7.9). Pot work indicated that the trouble could be overcome by leaching the soil with a 1 per cent solution of sulfuric acid at the rate of one gallon per square foot. The soil so treated was leached of acid with an equal volume of water and then supplied with a complete fertilizer mixture. In the absence of the sulfuric acid treatment, fertilizer materials of superphosphate, potassium sulfate, and ammonium sulfate, either alone or together, were ineffectual. The iron of ferric chloride was not assimilable. Although snapdragons

suffered markedly from the high amount of lime, stocks were quite tolerant and did well.

The Effect of Temperature on the Nitrate Content of the Soil and Plant Growth in the Presence of Decomposing Cellulose. (L. H. Jones and James E. Fuller). One per cent of cellulose in a soil maintained at constant temperatures ranging from 7° to 35° C. definitely affected the nitrate content of the soil. The tomato, because of its upright habit, was employed as an indicator plant. If the soil is one with a high level of fertility, the plants are unaffected by the reduction in nitrates and the differences obtained in plant growth were directly the result of temperature, a marked increase in growth occurring at a temperature of 22° C. and above. However, if the soil had a low level of fertility, temperature ceased to affect plant growth and the response of the plant was dependent upon the available nitrogen. The presence of decomposing cellulose in such a soil reduced the dry weight of the plants as much as one-half to two-thirds of the weight of plants grown in a soil to which no cellulose had been added. With a soil rich in nitrogen the addition of cellulose caused a considerable depletion of nitrates at the lower temperatures, while at higher temperatures nitrification was sufficiently active to replace the nitrate used by the cellulose decomposing organisms. In a poor soil to which a considerable amount of cellulose was added the ratio of nitrate to cellulose appears to have been so small that temperature had little influence on the degree of nitrate depletion, the rate of nitrification, or the response of the indicator plant.

Temperature Control Tanks. (A. Vincent Osmun and L. H. Jones). Many changes and improvements have been made in the apparatus for maintaining constant soil temperatures. Better results are now obtained with less attention and lower maintenance cost. In conducting an experiment of three months' duration no adjustments were necessary except the replacement of a loose nut on one of the contactors. Each of the thirteen compartments maintained its temperature throughout the period. This apparatus is available for many types of research. It has been of invaluable assistance in the study of the following problems: the smut disease of onions, black root-rot and brown root-rot of tobacco, nematode galls, growth of gladiolus in the greenhouse, soil temperature in plant containers, Verticillium wilt of eggplant.

An Electric Steam Generator for Sterilizer Retorts. (Howard Bidwell and L. H. Jones). This steam generator was developed to fulfill the requirements of obtaining a sterilizing pressure quickly, and is a decided departure from the usual type. About 80 per cent of the water volume in the boiler is available for supplying steam to the sterilizing chamber, without danger of low water, or requiring intake of additional water during the sterilizing process. The principle on which this generator operates is original and eliminates the usual delay in obtaining the required sterilizing pressure. The generator is under automatic control at all times, thus reducing necessary attention to a minimum. The details of its construction and operation are given in a paper entitled "Packed heat from a new type electric steam generator" accepted for publication in *Industrial and Engineering Chemistry.*

THE CRANBERRY STATION

(East Wareham, Massachusetts)

H. J. Franklin in Charge

The station has enjoyed for the first time, during the most active part of the 1930 cranberry season, the effective cooperation of the extension services of Plymouth and Barnstable Counties. These counties together hired a special agent, an experienced cranberry grower of Kingston, Mass., to conduct the cranberry extension work from the middle of May till the middle of August. The work was handled satisfactorily, and more time was available for the station's research work in spite of an increase in the number of extension calls.

Injurious and Beneficial Insects Affecting the Cranberry. (H. J. Franklin). Various samples of pyrethrum soap were tested on different kinds of insects to guide manufacturers of these soaps in improving and standardizing their products. Bog tests of pyrethrum soap sprays brought out clearly that such sprays are entirely safe to use on cranberry vines whenever it is safe to spray with nicotine sulfate and soap. They are likely to cause serious loss by blasting blossoms or newly set berries or by stunting small berries if they are applied while the vines are in full bloom or before the berries are well started in growth. Pyrethrum extracts without soap, such as Evergreen, did harm to blossoms and small berry sets in some cases, but were generally much less injurious than pyrethrum soap. The season's experience with pyrethrum soap sprays leads to the conclusion that such sprays are preferable to nicotine sprays for treating the first brood of the black-headed fireworm (*Rhopobota vacciniana*), for they are fully as effective and kill much more promptly. The prompt kill is a great advantage, especially if it rains soon after the spraying is done.

Penetrol, used in sprays as directed by the manufacturer, did material injury when applied to cranberry vines during and just after the blossoming period.

Bog tests showed that it takes an application of sodium cyanide solution about sixteen hours to kill a satisfactory percentage of an infestation of the cranberry root grub (*Amphicoma vulpina* Hentz.). Tests with herring in tubs of water containing samples of treated bog soil showed that the cyanide poison used to treat this grub persists in the soil in considerable strength at least a week. In treating the soil, six ounces of the cyanide had been used to a hundred gallons of water, and the solution had been applied at the rate of a gallon to the square foot. This treatment has proved satisfactorily effective in killing these grubs in all their stages including the flaccid stage that comes just before pupation, but it seems to kill the pupae much less readily. It should therefore always be completed before the grubs begin to pupate.

Submergence tests were conducted with partly grown nymphs of the cranberry black bug (*Plagiognathus repetitus*) and of the false blossom leafhopper (*Ophiola striatula* Fallen). The insects, in tin coffee cans with muslin tied over the tops, were submerged to a depth of about a foot in Spectacle Pond at East Wareham. A complete twelve-hour submergence was not enough to kill all the nymphs of either of these two species; but

eighteen hours killed them all. It appears, therefore, that these pests can be controlled more safely by flooding in June than has heretofore been thought possible.

In cooperation with the Bureau of Plant Industry, a very satisfactory chemical color test was developed for determining roughly the oxygen content of water used in bog flooding. This test is so simple that it may be used readily by cranberry growers.

Cranberry Disease Work. (H. J. Franklin in cooperation with the Bureau of Plant Industry, U. S. D. A.). Forecasts of the very poor keeping quality of the fruit of the 1930 cranberry crop were made by the station. They were based on weather records and incubator tests and proved to be timely and accurate.

Weather Observations. (H. J. Franklin). Local weather observations were made and reported to the office of the Weather Bureau at Boston, and further records bearing on frost forecasting were gathered from various special stations as in previous years.

Forecasts of minimum bog temperatures were made in the frost seasons in the early afternoon and early evening and distributed by telephone as heretofore. Frost conditions were so accurately determined that flooding for frost protection was not once begun unnecessarily at the station bog, and three of the four times that such flooding was done there the water was started on in the middle of the afternoon. No one ever remained at the station to watch conditions after the early evening observations were made, and the amount of injury to the bog from frost was negligible.

Southeastern Massachusetts, in common with much of the rest of the country, had the worst drought during July that it has experienced in a great many years. Advantage was taken of this to gain information about the effects of drought on cranberry fruiting. For this purpose plots were laid off on Early Black and Howes sections on the station bog and were watered with about two inches of water once a week during the drought period. The water was put on with a hose, the open end of which was pushed in among the vines at intervals so as to wet the soil well without wetting the vines. The berries from these plots and from unwatered checks near them were picked on the following dates: Early Black variety on September 6; Howes variety on September 18. The berries from the watered areas were notably larger in all cases than were those from the checks, as shown by the following average cup counts (the inspectors' cup of the New England Cranberry Sales Co. being used):

Variety	Cup Counts	
	Watered Areas	Checks
Early Black	114	140
Howes	145	165

The average quantity of fruit per unit of area was 50 per cent greater by weight and 55 per cent greater by volume from the watered areas than from their checks. The berries from the watered areas had a much better color than those from the checks and were evidently fully ten days ahead in ripening.

Varieties. (H. J. Franklin). The study of cranberry varieties, their

characteristics and correlations received more attention during the year than any other one line of investigation. It was found that the most desirable varieties, as measured by productiveness and disease resistance, seldom or never develop berries with more than four locules, while berries with five or six locules are not uncommon among the fruit of many inferior varieties. As a result of these studies with cranberry varieties, the following conclusions have been reached:

(1) *Disease resistance is a unit.* In other words, varieties that resist one disease notably tend to resist other diseases well.

(2) *Disease resistance is an intimate co-function with productiveness.*

(3). *The significance of the important correlations bearing on productiveness and disease resistance apparently may be expressed by the following formula:*

$$P+R+M=T-W$$

In this formula, P is productiveness as measured by the number (not the quantity) of berries produced to a unit of area, R is the amount of disease resistance, M is the minimum of plant structure necessary for the fruit production, T is the total result of the constructive work done by the vital activities of the plants, and W is the total of the varietal wastes. The following are the leading wastes so far noted and determined:

(a) *Seeds.* Only a few small seeds are necessary. The more numerous and the larger the seeds, the more they tax the plant economy needlessly.

(b) *Wax.* A bloom on the fruit is not essential, and its development seems to be very costly to the vines.

(c) *Sugar.* Much sugar in the berries is not essential.

(d) *Pectin.* This has not been studied much yet, but it is likely to be one of the wastes.

(e) *Excessive vine growth,* as indicated by coarseness of the vines or tallness of the uprights or both.

As M in the above formula should be practically the same for all varieties, the value of P+R necessarily varies directly with the value of T—W; and since the accumulated records and observations of the actual performance of different varieties indicates that the value of P+R is inversely and greatly dependent on the value of W, it seems probable that T varies only moderately on the average. As will be seen, when the value of T—W is low, P can have a high value only when the value of R is low and vice versa.

Through special assistance during the summer months, the photosynthesis of several of the leading varieties was studied. Hydrogen-ion determinations were made of the fruit of a large number of varieties and the pH value was found to be about 2.6 with all varieties at all times during the picking and storage season.

Cultivated Blueberries. (H. J. Franklin). Fairly extensive counts of the seeds of quite a number of cultivated blueberry varieties were made and it was found that the most desirable varieties, as measured by the quantity and size of berries produced, had notably fewer seeds than the others in nearly all cases.

DEPARTMENT OF DAIRY INDUSTRY

J. H. Frandsen in Charge

A Study of Packaged Ice Cream. (K. E. Wright). This project has been continued throughout most of the year, and the results have been tabulated and published as Bulletin 269.

The Effect of Initial Cooling Temperatures on Gelatin in the Aging of the Ice Cream Mix. (K. E. Wright). Work so far completed on this project indicates that much of the texture benefits resulting from aging an ice cream mix are associated with the viscosity imparted by gelatin, and that high initial temperature in the aging period favored the development of greater viscosity. It was also determined that the maximum viscosity was found to be imparted when the mix was allowed to cool from 80°-100° F. to 40° F. without agitation, and that the whipping property was decreased as the viscosity increased.

This work as far as completed indicates that the results of aging an ice cream mix are dependent upon the factors affecting crystallization of the gelatin portion of the product.

Factors Affecting the Aging Time of Ice Cream Mix. (K. E. Wright). Work so far completed would indicate that the solidification of fat in the aging of the mix is a minor factor and that the adsorption is probably the important factor.

Only 50 per cent of the benefits of aging in a 24-hour period are obtained during the first 4 hours, and the rate of adsorption or whip improvement appears to depend on the amount of emulsifying agent available, i.e., a butter mix improves more slowly than a cream mix or one containing egg yolk. A fairly satisfactory relation was found between the surface tension and the ease of whipping. In all cases a decrease in surface tension was noted after a 24-hour aging period. Cream mixes were found to have less surface tension than butter mixes. Buttermilk was found to have a lower surface tension than skimmilk, and the addition of buttermilk to a butter mix lowered the surface tension of the mix and improved its whipping property.

Extractions of egg yolk with various fat solvents indicated that the solvent altered the emulsifying agent. An ice cream freezer was developed which was found to be very useful for experimental freezing and is an improvement over the commercial freezer because of its smaller capacity. Chemical study of the emulsifying ingredients of ice cream mixes is being continued along with cataphoretic measurements of the effects of the ingredients which aid emulsification.

A Study of Frozen Sweet Cream for Use in Ice Cream. (M. J. Mack). This project has been active the last two years and full report is published in Bulletin 268.

The Utilization of Frozen Fruits in Ice Cream. (M. J. Mack). This study is being conducted in cooperation with the Department of Horticultural Manufactures. The third crop of such fruits as strawberries, raspberries, cherries, and peaches is now being studied. This year the fruit has been packed with cane sugar in fruit to sugar ratios of 2:1 and 3:1, with sugar syrup, with invert sugar, and in partial vacuum. Fruits preserved in these different ways are being compared in order to determine their relative merits for use in ice cream.

Use of Gelatin in Ice Cream. (W. S. Mueller). Investigation for new uses of gelatin in ice cream has resulted in developing (1) gelatin fruit cubes, (2) modified Aufait ice cream, (3) filling for ice cream pies and cubes. The same principle is employed in all these uses; namely, the addition of edible gelatin to fruit juice or to a water solution containing fruit acid. Crushed fruits may also be added. The fruit cubes are cut to ¼ inch size and scattered into the ice cream at time of drawing. Modified Aufait ice cream is made by placing layers of jellied fruit juice, with or without crushed fruit, into brick ice cream. The filling for the ice cream pies is similar to the material used in making the modified Aufait ice cream. Some difficulty has been experienced in keeping the jellied fruit juice clear, due to the low temperatures to which it must necessarily be subjected when used in ice cream. This troublesome ice crystallization has been largely overcome by using the correct amount and kind of sugar and also maintaining the correct amount of acidity. A variety of sugars; namely, cane, corn, invert and corn syrup, has been used in various combinations. Freezing point determinations are being made for various sugar-gelatin-H_2O solutions. The addition of jellied fruit juice to ice cream seems desirable from the standpoint of attractiveness which the clear, bright-colored jellied fruit juice gives to the ice cream.

A study of the effect of time and temperature in cooling an ice cream mix upon the behavior of gelatin has been made. Initial cooling temperatures ranging from 0°C. to 60°C. were used. An initial cooling temperature of 20° C. for 4 hours gave the maximum basic viscosity, increased the gel strength, increased melting resistance and improved the texture for the particular mix used. A study is now under way to determine what factors influence the degree of results obtained when using a high initial cooling temperature. The following factors are being studied:

1. Strength of gelatin
2. Amount of gelatin
3. Amount of butterfat
4. Amount of serum solids
5. Amount of sugar
6. Source of butterfat and serum solids

A new type of colloid mill is being used experimentally in place of a homogenizer for processing ice cream mixes. The effect upon the physical properties of the mix and the desirability of the finished product are being studied.

Preliminary experimental work on the value of gelatin in retarding "sandiness" in ice cream has shown that gelatin has a greater value in this respect than is generally conceded.

A number of commercial stabilizers are being used with gelatin in ice cream. Preliminary experiments have shown a mutual precipitation of gelatin with some of the stabilizers and no mutual precipitation with others. Experiments are now being planned to determine the cause for this mutual precipitation.

The Comparative Efficiency of Electrically-operated Tanks Versus Ice in the Cooling of Milk. (J. H. Frandsen). Whether the tank is of home construction or specially manufactured, it is essential that it be of ample capacity; roughly speaking, when filled with cans to full capacity there should still be room for twice as much water and ice as milk. If the tank

is of home construction, there should be at least 3 or 4 inches of cork or its equivalent and this of course must be protected against moisture. Such insulation saves more than its cost in saved refrigeration in one season. Electric cooling of milk is entirely practicable. The machines tested are convenient, reliable, and, if well adjusted, economical, although the probable service cost and annual depreciation charge were not determined. Electric milk cooling tanks are a distinct labor-saving device and are more sanitary than natural ice.

DEPARTMENT OF ENTOMOLOGY

A. I. Bourne in Charge

Investigation of Materials Which Promise Value in Insect Control. (A. I. Bourne). Further studies were made of the different types of oil sprays with special reference to European red mite control. Red mite infestation was comparatively light throughout all the college orchards. Under such circumstances all the oils gave satisfactory control with but slight distinctions between types.

Quad and triplex nozzles proved to be as satisfactory as spray guns and superior to old-type rod and nozzles. They were superior to guns in maintaining a mistlike spray enveloping the trees, and coverage was practically as rapid. Guns were superior under unfavorable wind conditions.

Weather conditions were favorable during the delayed dormant period. The temperature was somewhat above normal, but not excessively so as in 1929. No injury was noted following any oil spray used.

Of the miscible oils, Sunoco, Scalecide and Dendrol showed their customary high efficiency; well over 95 per cent control. Of the emulsions, Kleenup at 4 gallons to 100 gave 95 per cent control, somewhat better than results in 1929.

Tests of miscible oils combined with commercial copper fungicides and of soapless emulsions with lime-sulfur showed no injury to the trees or lessened insecticidal efficiency of the oils.

Comprehensive tests of relative coverage of different oil sprays and of lime-sulfur, in a block of 15-year-old apples selected because of the uniformity of size and spread of the trees, indicated a considerable superiority of the oils over lime-sulfur in material and time necessary to spray the same number of trees. The differences between the various types of oil sprays were comparatively small, and would not point to appreciable superiority of any one type over another when considered on a commercial basis.

In cooperation with The Pomology Department, tests were made with some of the materials or combinations of materials designed to replace lead arsenate as a stomach poison or to furnish a fungicidal action equal to lime-sulfur and at the same time avoid the toxic effects of the lead arsenate–lime-sulfur combination upon fruit and foliage.

Calcium arsenate in combination with aluminum sulfate and lime-sulfur, with lime-sulfur alone and with the addition of excess lime was used in a block of five varieties of apples which included four of the so-called "New England Seven", namely Baldwin, Northern Spy, R. I. Greening and McIntosh. These sprays were compared with the standard lead arsenate–lime-

sulfur combination used with and without the addition of a casein spreader. The schedule which was followed consisted of a pre-blossom and a calyx spray, two cover sprays, and an apple maggot spray in July.

The aluminum sulfate–calcium arsenate–lime-sulfur combination showed excellent persistence and caused neither injury to foliage nor russeting of fruit.

Calcium arsenate and lime-sulfur showed good adhesive qualities but caused considerable burn to foliage of McIntosh and serious burn on other varieties. With the addition of excess lime burn was not so severe but was present on all varieties including McIntosh. Both sprays caused a considerable drop of leaves during June and July, although to a less degree when excess lime was added.

Slight burn was noted following the lead arsenate—lime-sulfur combination both with and without casein spreader. The varieties showed considerable difference in susceptibility to burn. Injury was most pronounced on foliage of Baldwin and King; least so on McIntosh.

Flotation sulfur and calcium sulfide, two new materials designed to replace lime-sulfur as fungicides, were used in combination with lead arsenate to test their compatability with that material. These were used in blocks of McIntosh, a variety subject to scab, and Baldwin, which is very susceptible to spray burn and russeting. Neither of these materials caused injury to foliage or russeting of fruit on either variety, and both showed good coverage and excellent persistence throughout the season.

The comparative value of these sprays is shown in the following table, based on examination of the McIntosh crop at harvest.

McIntosh Apples, Block A

Treatment	PERCENTAGE OF FRUIT SHOWING Scab	Insect Injury
Calcium arsenate Aluminum sulfate Lime-sulfur	0	37
Calcium arsenate Lime-sulfur	2	20
Calcium arsenate Lime-sulfur Excess lime	2	28
Lead arsenate Lime-sulfur	0	20
Lead arsenate Lime-sulfur Spreader	2	14
Check	54	58

McIntosh Apples, Block E

Flotation sulfur Lead arsenate	0.2	11
Calcium sulfide Lead arsenate	4	8
Lead arsenate Lime-sulfur	4	20
Check	55	49

All of the sprays showed excellent control of scab as compared with unsprayed checks. Combinations containing calcium arsenate controlled scab as well as did those containing lead arsenate, but were slightly less efficient against insect pests. Flotation sulfur and calcium sulfide combined with lead arsenate controlled scab as well as or better than the lead arsenate—lime-sulfur spray and showed somewhat better control of insect pests. The record on Baldwins showed similar results except that scab was practically absent in all the sprayed plots.

Control of Onion Thrips. (A. I. Bourne). The dry, hot weather early in the season interfered somewhat with the growth of both set and seed onions and threatened an early and heavy infestation of thrips. Subsequent rains during June and July allowed the plants to make rapid recovery and tended to retard the development of the insects. As a result, thrips were but moderately abundant and caused less injury than in 1929 except in some fields of seed onions adjoining sets.

The seasonal development and activity of thrips were normal and occurred at the usual periods. This insect did not reflect the tendency of the season to be somewhat earlier than usual, which was very noticeable in many crops as well as insects.

Observations, through the growing season, of a field of seed onions at a distance from sets showed the infestation of thrips to be negligible up to July 7, from July 21 to 28 it averaged 25 to 40 thrips per plant, and reached its peak during the week of July 28 to August 4 with an average of 40 to 42 thrips per plant. This coincided very nearly with the point where the plants had reached maximum height. Beyond this point the numbers of thrips fell rapidly. In this field the plants showed little scarring and matured a good crop.

In contrast to this, a field similar to the above but subject to infestation from an adjoining field of set onions was found to be infested early in the season, and by July 7 the number of thrips had reached an average of 35 per plant. By July 14 noticeable injury was taking place. The peak of abundance was reached on July 28 with an average of more than 80 thrips per plant. Plants in this field were not making satisfactory growth and were badly scarred by the insects. Two applications of the nicotine-soap spray reduced the average infestation from 80 to 10. These plants revived somewhat and made new growth but matured a small and rather inferior crop.

Several species of insects predacious on thrips were collected in onion fields. Their numbers were insufficient, however, to make any significant impression upon the infestation.

Four applications of nicotine soap spray were necessary to protect seed onions growing alongside fields of sets. Due to the transferrence of thrips in large numbers from the sets and consequent early colonization of the small, tender plants of seed onions, two of these applications were made earlier than would be necessary on fields not so exposed.

In connection with the study on blast in cooperation with the Botany Department, spraying and dusting experiments were conducted with Bordeaux mixture, commercial copper fungicides and with milk of lime, alone and in combination with nicotine. The weather conditions prevailing during the summer were unfavorable for the development of blast. Mildew was also absent. In the absence of disease, no appreciable increase or de-

crease in yield resulted from dusting. Yields were increased somewhat by applications of Bordeaux sprays. Onion fields in the Valley were observed at frequent intervals during the growing season to note the appearance and extent of disease and insect pests. No instance of blast or mildew was discovered. Dry weather and a moderate infestation of thrips were the chief factors affecting the crop.

Control of the Plum Curculio in Apples. (W. D. Whitcomb, Waltham). Although fruit growers secured better control of the plum curculio in 1930 than in recent seasons, this appeared due to cumulative benefits from improved control measures and timely spray applications rather than to a noticeable increase in natural mortality. The infestation, determined by the number of larvae emerging from one bushel of unsprayed dropped apples in 1930 was 3047, compared with 3137 in 1929, and 2379 in 1928.

Preliminary studies of the effect of temperature on the activity of the plum curculio showed that beetles confined at temperatures above 70° F. made three times as many punctures (1991) as those held below 70° F. (629). The corresponding number of punctures at normal outdoor temperatures was midway between the two extremes (1191).

The effect of maximum daily temperatures on curculio activity as determined from insectary records of the past four years is variable yet shows an average increase of 12 to 27 punctures per day for each 10° rise in temperature.

Beetles feeding on well-sprayed fruit of normal size at the time of the calyx spray lived 10.6 days, and when supplied with normal fruit one week later they lived 10.3 days. With sprayed fruit gathered two weeks and three weeks after the petal-fall period for food, the beetles died in 4.9 days and 3 days respectively.

In both laboratory and field experiments, barium fluosilicate and synthetic cryolite failed to control the plum curculio as well as equal amounts of lead arsenate. Chemical hydrated lime added to the lead arsenate–lime-sulfur combination spray was also less effective than the standard solution. Molasses, fish oil, or linseed oil used as a sticker with lead arsenate was more effective than flour paste or calcium caseinate. An 85-15 sulfur–lead arsenate dust was very effective in the laboratory, but barium fluosilicate-lime, cryolite-lime and naphthalene-lime dusts failed to kill the beetles.

The Spray Residue Problem. (A. I. Bourne). Another season of light rainfall again emphasized the necessity of careful arrangement of the spray schedule in order to avoid arsenical residue on fruit at harvest, in excess of the established limit of tolerance. Rainfall was considerably below normal, although the deficiency was not as great as in 1929. The fact that the greatest shortage was in late July and August was of considerable significance, since it followed the sprays applied in late July for apple maggot and codling moth control, increasing the risk of residue from those applications.

Attention was centered chiefly upon commercial orchards where the schedule included one or two July applications of spray, and on those which were dusted once or more in August. Cooperative tests of different dust materials were made in one commercial orchard.

Analysis of fruit from these orchards shows that in a season such as

1930, Wealthy and similar varieties should not be sprayed later than about July 10. If further protection is necessary, dusts should be used. McIntosh sprayed as late as the third week of July showed a sufficient margin of safety unless heavy, drenching applications were made. Baldwins could be sprayed through July with safety. In all cases where sprays are applied after July 15, any spreading or sticking agent should be omitted and lighter strength of lead arsenate should be used.

Results showed that dusts, if properly applied to McIntosh or Baldwin, could be used as late as August 15 without encountering any difficulty.

The Biology and Control of the Carrot Rust Fly. (W. D. Whitcomb, Waltham). The average over-wintering population of the carrot rust fly at Waltham in 1930 was 39 pupae per square foot where infested carrots remained in the soil, compared with 79 per square foot in 1929, and this should have produced a normal moderate infestation in early carrots. However, the injury by the first generation was negligible, apparently due to the dry, hot weather during the oviposition period in early June. Under laboratory conditions twenty eggs kept in the greenhouse at temperatures always above 70° failed to hatch, while a similar number of eggs in a root cellar maintained at 60°-70° F. hatched perfectly in twelve and thirteen days.

The normal second generation infestation was consequently very light, but a moderate amount of injury was caused in October by a combination of third generation and late second generation maggots. Flies emerged as late as November 10.

Carrots planted May 1 or later were free from injury by the first generation, and the variety plantings showed no definite degree of immunity because of the general light infestation.

Early carrots were very free from injury when grown with or without paper mulch, but those under paper were 20 per cent heavier.

The results of the insecticide treatments in the field were inconclusive because of the light infestation. Carrots grown from seed treated with calomel showed considerable mercury russeting.

Derris dust, both pure and diluted 1-2 with gypsum, was very effective in killing the adult flies, and prevented oviposition, while eight other materials were much less effective, in the laboratory.

All larvae in infested harvested carrots were killed by fumigation with paradichlorobenzine and carbon disulfide. The carbon disulfide used at the rate of 4 ounces for each 100 cubic feet for eighteen hours was the better treatment.

Systematic Study of Oil Sprays. (A. I. Bourne in cooperation with the Department of Chemistry). During the winter, laboratory tests were made of the stability of samples of oil sprays prepared by the Chemistry Department, to determine the relative value of different emulsifying agents as well as of various proportions of oil and emulsifier.

Three samples of oil sprays were submitted for preliminary orchard tests. These consisted of a miscible oil (83⅓ per cent oil), and two types of oil emulsions (66 per cent oil). Two of these gave promising results and indicated the direction for further development of the work.

Apple Maggot Control. (A. I. Bourne). The serious nature of this pest, its abundance in recent years, and the threatened loss of foreign

markets for Massachusetts apples led to a study of different control measures and any adaptations necessary for Massachusetts conditions. The work was done in cooperation with the Extension Service and in conjunction with the county agents.

The twelve orchards chosen for the tests represented, in their size, type, location, etc., a very fair cross section of the fruit growing industry of the State, and in every case maggot had caused serious loss to the crop of the previous season.

The program called for—

(1) Regular and thorough collection of premature drops during the period of maggot infestation, and prompt disposal of such infested fruit.

(2) Treatment, either by spraying or removal, of neglected trees or orchards within 200 yards of the test blocks. In many cases this involved arrangements with neighboring owners, sometimes difficult to accomplish.

(3) Thorough spray or dust program to protect fruit and foliage during the period of activity of the adult flies.

In determining results McIntosh was the variety checked, since this was common to all the orchards. In the ten orchards where the program was carried out in full, maggot infestation in fruit scored was less than 1 per cent. Records of infestation in some of these orchards in 1929 showed the following comparison:

Orchard No.	Percentage of Maggot Infestation 1929	1930
1	25	0
2	90	.8
3	26 (Baldwins 40)	.3
4	Destroyed practically entire crop because of maggot infestation	.1

Supplementary observations on other varieties supported the results noted on McIntosh. The Cortlands in one orchard in 1929 were so badly riddled by maggot that the grower trucked the entire crop to the cider mill. In 1930 this variety showed but 2 per cent infestation.

Orchard surveys conducted by state and county agencies showed that apple maggot was present in considerable abundance throughout the State in 1930. In one instance an infestation of 78 per cent was noted, and in several orchards fruit showed 30-40 per cent damage. In very many cases an infestation of 10-15 per cent was noted. The results secured in the test orchards, therefore, would not appear to be attributable to any scarcity of the pest this past season.

In addition to checking apple maggot, the spray program in the test orchards enabled the growers to control many other pests and made it possible for them to harvest better quality fruit. Five of the ten growers produced McIntosh, 90-95 per cent of which was free from insect or disease blemishes. In three other orchards the fruit scored 80-85 per cent clean. The improvement made by these growers in the quality of the fruit produced is indicated by the following examples:

Orchard No.	Percentage of Crop Clean 1929	1930
1	1.6	51
2	10	83
3	40	82
4	Less than 10	95

One of the most encouraging features of the campaign was the fact that the late sprays or dusts recommended for control of the apple maggot gave such excellent protection against other pests as well that their use was justified aside from the question of maggot control.

DEPARTMENT OF FARM MANAGEMENT

J. A. Foord in Charge

Enterprise Relationships and Farm Organization on Selected Dairy Farms in Western Massachusetts. (R. L. Mighell). The work on this project has been somewhat more specialized than last year. Simple financial records have been continued by the owners of the farms used in the project. A more detailed study of several of the farms, based on the records already obtained, has been made by the investigator and some suggested changes in organization have been adopted. Time studies of several farm operations have already been made and more are in progress.

Types of Farming in Vegetable Garden Areas. (F. H. Branch and R. L. Mighell). This project was begun as a part of the extension work of the department, but owing to the demand for information, it seemed wise to make it one of the major projects for investigation. The Extension Service contributed funds for obtaining the data in the field; and the work was done during the summer. More than a hundred growers in the counties of Bristol, Essex and Middlesex were visited, and 320 enterprise records obtained. The tabulation and study of this material revealed important differences and several special types of organization.

The material will be available for Extension Service use this winter and also serve as a basis for investigations in these areas in the future.

Live Stock Management, Methods and Costs. (J. A. Foord). Data are being accumulated on the methods and expense of eliminating Bangs Disease in herds, as well as the advantages and labor involved in different methods of housing and handling dairy cattle.

FEED CONTROL SERVICE

Philip H. Smith in Charge

The Feed Control Service comprises not only feed inspection, but several other activities, as listed below:

Feed Control (General Laws, 1920, Chapter 94)
Seed Control (General Laws, 1927, Chapter 94)
Dairy Law (General Laws, 1920, Chapter 94)
Advanced Registry Testing
Miscellaneous Work

Feed Control. (P. H. Smith, H. R. DeRose, A. F. Spelman, G. J. Larsinos, J. B. Zielinski, Jr.[1], J. W. Kuzmeski[2], F. A. McLaughlin, J. T. Howard). During the fiscal year, 1,738 samples of feeding stuffs officially collected were examined in the control laboratories. The results show that at least 96 per cent of the samples collected varied less than one per cent from stated guarantees in protein, fat and fiber content. The gross receipts from the registration of feeding stuffs in 1930 (calendar year) were $21,000, derived from 1,050 brands at $20 each.

Seed Control. (P. H. Smith, F. A. McLaughlin, O. W. Kelly[3], Elizabeth F. Hopkins[4], Margaret E. Nagle). From October 1, 1929, to October 1, 1930, the seed laboratory analyzed 854 seed samples, 349 of which were collected by the State Commissioner of Agriculture, 390 sent in by dealers and farmers, and 115 from the Rhode Island State Commissioner of Agriculture. Classification of these analyses is shown by the following summary.

Summary of Samples Analyzed

	Rhode Island	Non-Official	Official	Total
Purity only	20	18	18	56
Germination only	4	235	216	455
Purity and Germination	91	137	115	343
				854
Field Crops	7	120	18	145
Forage	104	103	115	322
Vegetables	4	158	216	378
Tree		9		9
				854

Field tests to determine trueness to type were again conducted in cooperation with the Department of Agronomy which tested 16 samples of red clover, 4 of sweet clover and 11 of alfalfa, and the Department of Vegetable Gardening which tested 132 varieties and strains of varieties of onions.

Dairy Law. (P. H. Smith, J. T. Howard, H. L. Allen). During the year ending December 1, 1930, 8,871 pieces of Babcock glassware were tested, an increase of 356 over 1929. Condemned glassware consisted of 13 milk pipettes, which were not condemned on account of inaccuracy of graduation but because they did not meet with accepted standards; the graduation mark was so near the suction end of the pipette as to render pipetting difficult. Ninety-four certificates of proficiency were awarded.

[1] Resigned Oct. 1, 1930.
[2] Resigned Jan. 1, 1930.
[3] Resigned June 1, 1930.
[4] Temporary appointment for month of July.

One hundred and sixty creameries, milk depots and milk inspectors' laboratories were visited in order to check methods and pass upon equipment in use. As a result of this inspection, three machines were condemned outright, major repairs were ordered on five, and minor on twelve. In eighteen places new glassware was ordered, and at four, operators were cautioned on account of improperly cleaned glassware. Twenty-seven places were ordered to keep composite samples in better condition. Where it is thought necessary, re-inspections will be made. At the request of interested individuals, special investigations were also made at four different plants.

Advanced Registry Testing. (P. H. Smith). Advanced registry testing has been supervised by this department since its beginning in 1902. This work has been carried on for so long that there is no material growth in it from year to year. The work at this time (November 1929) is of practically the same volume as it was a year earlier. There are now on yearly test 602 cows located on 77 different farms. This does not include the herd tests where all animals in each herd are placed on test. Of these there are eighteen, six of which are supervised by men sent out from this office and twelve by cow-test association supervisors.

Miscellaneous Work. (P. H. Smith, J. W. Kuzmeski, J. B. Zielinski, Jr., A. F. Spelman, G. J. Larsinos). Numerous analyses have been made for residents of the State and other departments of the College. Especial attention is called to the increasing number of dry matter determinations in connection with forage crop experiments. This work has become a real burden upon other work of the department and should it increase materially, the employment of an additional assistant during the summer months will be necessary.

Summary of Miscellaneous Work, 1930

Materials sent in:	
Milk and cream, butterfat only	388
Milk, solids and fat	28
Feeds	66
For other departments of Experiment Station and College:	
Milk, for butterfat	200
Dry matter, forage crops	1,324
Complete fodder analyses	177
Dry matter and nitrogen	127

FERTILIZER CONTROL SERVICE

H. D. Haskins in Charge

Fertilizer Inspection. (H. D. Haskins, H. R. DeRose, A. F. Spelman, J. B. Zielinski, Jr., and G. J. Larsinos). During the season, 135 firms or individuals have registered for sale in Massachusetts 598 brands of mixed fertilizers and unmixed fertilizing materials and 26 brands of agricultural lime and gypsum. The nature of these materials, as well as statistics with reference to the inspection, is given in the following summary.

Products	Brands Registered	Brands Collected	Samples Collected	Number of Analyses	Number of Determinations*
Mixed fertilizers	361	338	1153	394	5122
Ground bone, tankage and fish	59	51	134	60	316
Nitrogen products, organic and mineral	76	64	240	149	330
Phosphoric acid products	30	28	100	31	155
Potash products	34	30	69	39	149
Dried, pulverized natural manures	21	21	80	23	115
Miscellaneous	10	8	16	14	71
Lime products	26	26	41	29	145
Nitrate of potash	6	5	11	7	28
Ammonium phosphate	2	2	5	4	24
Totals	625	573	1849	750	6455

* Not counting check tests or repeats, which would probably amount to one-third more in number.

The four men employed to secure samples for the year's inspection sampled 19,631 sacks or containers, representing 5,875 tons of material; 912 agents were visited.

From July 1, 1929, to July 1, 1930, the tonnage of fertilizer and plant food sold in Massachusetts was as follows:

	Fertilizer (Tons)	Plant Food Elements (Tons)		
		Nitrogen	Available Phosphoric Acid	Potash
Mixed fertilizers	42,881	1,791	3,366	2,703
Unmixed fertilizer chemicals and materials	21,249	1,441	1,636	584
Pulverized natural manures	2,491	56	37	77
Totals	66,621	3,294	5,039	3,364

Full details of the fertilizer and lime inspection will be found in Bulletins 54 and 57, Control Series.

Miscellaneous Analytical Work. (H. D. Haskins, H. R. DeRose, J. B. Zielinski, Jr., and G. J. Larsinos). As usual, the last two months of the year and the first three months of the new year, much cooperative chemical work was carried on with other departments of the Experiment Station. The general nature and extent of this work may be seen from the following summary:

Cured tobacco, complete ash analysis	16
Complete fertilizer	1
Dwarf Essex rape plants, dry matter and phosphoric acid	81
Fertilizer chemicals and unmixed materials	3
Japanese millet plants, dry matter and nitrogen	101
Onions, partial ash analysis	1
Organic ammoniates, complete analysis including nitrogen activity	25
Phosphates, complete analysis for vegetation test	18
Soil analysis, partial chemical	29
Soil mechanical analysis	7
Tobacco plants, partial analysis	21

The fertilizer department has also been active in assisting the citizens of the State, through farm organizations, institutional departments, and in

personal contact with the individual, in the analysis of a variety of materials of interest to agriculture. Where the results of the work are of principal interest to the individual a nominal charge has been made as in the past. Interpretations and advice accompany the report of analysis in all cases. The following materials have been analyzed under this heading:

Complete fertilizers	11
Fertilizer chemicals and unmixed materials	73
Fish, tankage and bone	5
Lime products	1
Insecticides	1
Manures	3
Manufacturers' by-products, for fertilizer value	3
Miscellaneous	2
Peat products	15
Soils, complete chemical analysis	7
Soils, partial chemical analysis	12
Soils, mechanical analysis	10
Wood and cotton hull ashes	14

In addition, the usual amount of cooperative work has been done for the Association of Official Agricultural Chemists, consisting of analytical work for the Referee on Nitrogen, and service on the Committee on Definition of Terms and Interpretation of Results on Fertilizers and Lime Products.

Vegetation Pot Experiments. (H. D. Haskins, G. J. Larsinos and H. R DeRose). An experiment comprising 79 pots in a study of phosphoric acid availability of 18 phosphates was begun. It is hoped that the experiment may be continued for two years more before final conclusions are drawn. A vegetation experiment was also conducted in further study of the nitrogen availability of processed low-grade organic substances, oil-extracted seed residues and other organic nitrogenous materials which are largely used in mixed commercial fertilizers. Pots were also included to note the effect of manganese sulfate. Detailed results of these experiments are reported in Control Bulletin 54.

DEPARTMENT OF FLORICULTURE

Clark L. Thayer in Charge

Study of the Effect of Plant Nutrients on Carnations and Roses Under Glass. (H. E. White, Waltham). This project was started in June, 1930, with the aim of studying the effect of the sources of nitrogen and phosphorus (organic and inorganic) on growth and flower production. Fifteen plots of thirty-five plants each of carnations, triplicated, and fifteen plots of twenty-four plants each of roses, duplicated, were established; fifteen fertilizer treatments are being used.

Since the first heavy crop of carnations is just coming into bloom, it is not possible to present data on flower production. The plots receiving the following treatments have produced taller and heavier plants:—manure and superphosphate, manure and peat, superphosphate and peat. There

does not appear to be any visible difference between the remaining plots.

The rose plots which received manure and peat, superphosphate and peat, and manure and superphosphate have produced stronger plants and have given a few more blooms per plant during the month of November.

Definite conclusions cannot yet be drawn from the experiments, since the work has been in progress for a comparatively short time.

The following table shows the various plot treatments.

Plot No.	Treatment
1	Superphosphate Manure
2	Manure Peat
3	Superphosphate Peat
4	Nitrate of Soda Superphosphate Muriate of Potash
5	Nitrate of Soda Superphosphate Muriate of Potash
6	Guano Superphosphate Muriate of Potash
7	Fish Superphosphate Muriate of Potash
8	Fish Bone Muriate of Potash
9	Nitrate of Soda Bone Muriate of Potash
10	Urea Superphosphate Muriate of Potash
11	Calurea Superphosphate Muriate of Potash
12	Blood Superphosphate Muriate of Potash
13	Nitrate of Soda Basic Slag Muriate of Potash
14	Nitrate of Soda Superphosphate Muriate of Potash
15	Nitrate of Soda Basic Slag Muriate of Potash Swamp Peat 2:1

Breeding Snapdragons for Varietal Improvement and Disease Resistance. (H. E. White, Waltham). The work on the development of rust-resistant varieties of snapdragons for commercial use was started in June, 1930. Twelve rust-resistant strains, obtained from the Purdue University Agricultural Experiment Station, were planted in the field among ten garden varieties. By August 12 the garden varieties were destroyed by rust, whereas seven of the twelve resistant strains produced thirty plants that were entirely free from the disease. Since these strains do not possess flower color and length of stem desirable in commercial varieties, it will be necessary to breed plants having the desired commercial qualities and the rust-resistant characters. Breeding work was not done in the field due to the hot, dry weather conditions at the time the plants were in bloom. The resistant strains are now being grown in the greenhouse and will be crossed with commercial varieties during the winter and spring.

DEPARTMENT OF HOME ECONOMICS RESEARCH

Esther Davies in Charge

Present Practices of Massachusetts Elementary Schools with Regard to School Feeding and Transportation and Their Effects upon Health of Pupils. (E. Davies). The section of this project dealing with food service has been entirely completed and a bulletin published describing the

methods used in the study and the results obtained. (Bulletin No. 263; April, 1930).

The field work for the study of transportation of pupils to rural elementary schools has been finished and the data are in process of tabulation. The study includes consideration of methods of awarding transportation contracts, requirements as to type and condition of vehicles, behavior of drivers, planning of routes, length of time transported pupils are away from home, and the relation of transportation to school absences and various pupil illnesses. In most of the rural Massachusetts towns, the entire problem of transportation is settled on the basis of financial economy, the other factors being unregarded; while the experience of a few towns shows that transportation can, if sufficient thought is given to the matter, be so arranged that the health of the pupils is not adversely affected and, at the same time, costs be kept within reasonable bounds.

The Comparative Values of Milk and Tomato as Supplementary Feeding in a Rural Elementary School. (E. Davies and M. V. E. Voorneveld). After one year of experimental feeding in a rural school in the eastern part of the State, the study is being continued for a second year in a consolidated school of similar size and racial composition, in the Berkshires. The data cannot be tabulated until the end of the second year of experimentation, and it is not now possible to reach any conclusions as to the comparative value of the food stuffs studied.

The Value of Evaporated Milk for School Food Service. (E. Davies and O. A. Merriam). This project is similar in purpose and method to that concerned with fresh milk and tomato as materials for supplementary food service in schools. The experimental work is to continue for two years, and is being carried on in a village having a very large proportion of children of foreign-born parentage enrolled in the schools. No information regarding the outcome of the experimental work is available at the present time.

DEPARTMENT OF HORTICULTURAL MANUFACTURES

W. W. Chenoweth in Charge

Extraction of Fruit Juices by Heat. (C. R. Fellers). This project has now been completed and the results are being prepared for publication. Optimum extraction methods for jelly manufacture are outlined. A new rapid centrifugal method for the determination of pectin in fruit juices has been developed which is sufficiently accurate for ordinary work.

Concentrated pectin extracts made from cull apples or thinnings, are readily prepared, inexpensive, and, when freshly prepared, suitable for use in jelly making. However, after a few months' storage precipitation occurs, and the pectin loses much of its jellifying properties. Homemade pectin extracts should, therefore, be used while fresh.

A number of commercial benzoate cider preservatives were examined for suitability for use in freshly prepared cider and grape juice. Great differences were noted. In general, too much benzoate is added to cider, from .05-.06 per cent being sufficient if the cider is fresh and reasonably free from sediment. The sharp taste of benzoated cider is due largely to chlorine impurities in the preservative.

Several types of equipment designed to determine the jelly strength of jellies have been compared. Work is being done on the development of a new jelly tester similar in construction to the Magness fruit pressure tester.

Manufacture and Preservation of Cranberry Products. (C. R. Fellers, J. A. Clague, and W. W. Chenoweth). Close cooperation with the American Cranberry Exchange and the commercial cranberry preservers has been maintained. The use of the Abbé refractometer for determining the proper finishing point in cranberry sauce manufacture has been introduced into all of the commercial canneries. By this means the quality of the sauce is maintained and every batch can be standardized to a definite sugar content (42-44 per cent), insuring also maximum yields consistent with optimum jelly strength.

Frozen cranberries held at 10° F. for 1 to 12 months were found to be very satisfactory for sauce manufacture, the sauce retaining all the flavor, color and jelly strength of the fresh-fruit sauce. This year some of the canners are freezing several thousand barrels for manufacture during the off season.

Canned cranberry sauce was shown to be impaired by freezing. The jelly strength was decreased as much as 20 per cent and syneresis (bleeding) was greatly increased.

Researches are under way in cooperation with the State Cranberry Station on the suitability of about 30 commercial varieties for canning purposes. Strained and whole sauce is manufactured from each variety, the yield, characteristics and keeping qualities being noted.

The American Cranberry Exchange of New York, through a grant of $1000, requested the department to carry on nutritional studies on the cranberry. The first research attempted was a determination of the vitamin C content of raw cranberries and fresh and canned cranberry sauce. Preliminary results on 45 guinea pigs indicate that the raw cranberries contain substantial amounts of vitamin C, but practically all is destroyed by the manufacturing process. This work is being actively continued in order to evolve, if possible, a method of sauce manufacture which will protect the vitamin C. Cranberry juice is also a rich source of vitamin C, as little as 3 cc. per day protecting guinea pigs against scurvy for at least 90 days. The use of cranberry juice as a beverage is also being investigated.

Utilization of Onions by Canning. (C. R. Fellers). The examination of experimental packs of canned onions made in 1929 and 1930 fully bear out earlier conclusions as to the feasibility of canning onions in tin cans or glass jars. Chemical studies on canned onion discoloration are being conducted by the Chemistry Department. Continued tests on dehydrated cull onions and the ease of manufacture of onion powder or "flavor" have renewed confidence in the feasibility of utilizing cull onions in this way. Preliminary experiments on preserving small onions in brine for pickling purposes indicate that a 60 degree salometer brine is preferable to lighter brines.

Nitrogen Distribution of the Edible Portion of the Onion. (F. P. Griffiths). This project was discontinued upon the resignation of Mr. Griffiths on July 1, 1930. Nitrogen in the form of ammonia, nitrate, amino acids and protein was determined in fresh and dried onions.

Utilization of Frozen Fruits in Ice Cream. (C. R. Fellers and M. J. Mack, Dairy Department). This cooperative project has been continued for the third year, utilizing various varieties of strawberries, raspberries, cherries and peaches. For the first time fruits were packed with different syrup concentrations in place of solid sugar. Results to date indicate marked superiority of the sugar syrup packs of fruit. Oxidation, discoloration and mushiness are largely obviated by the use of 40 to 60 per cent sugar syrups. Invert syrup gave no better results than sucrose syrup. Corn sugar was distinctly unsatisfactory. Berries and cherries were frozen with solid sugar and with syrup in gallon cans under vacuum. These packs, though more costly to put up, gave the best quality of fruit. Hawaiian pineapples were superior to Porto Rican varieties for ice cream making. Preliminary work was done during the summer on freezing various vegetables.

Pasteurization of Dried Fruits. (C. R. Fellers and J. A. Clague). Further results have definitely proved that such dried fruits as dates, figs, and raisins may be effectively pasteurized and freed from insects and pathogenic bacteria by a heat treatment under standardized time-temperature-humidity relationships. This work has now been discontinued, the results being published in *American Journal of Public Health* Vol. 20, 175-181 (Feb. 1930) and *Journal of Bacteriology* Vol. 21, No. 1 (Jan. 1931).

Chemical Composition of Dates. (M. M. Cleveland). The Hills Brothers Company Research Fellow for 1931-32 is making a study of the organic and mineral constituents of dates, with special reference to nutritive properties. Possible uses for cull dates and date syrup are also included in this project.

Preservation of Rodent Bait. (In cooperation with U. S. Bureau of Biological Survey). Experiments have been conducted on the feasibility of preserving rodent baits containing red squill. If the canned product proves satisfactory, the use of poisoned meat, fish and cereals by farmers and others will be greatly facilitated.

DEPARTMENT OF HORTICULTURE

Frank A. Waugh in Charge

Turf Management. (L. S. Dickinson). The results of past studies of the appearance and control of the large brown patch disease (*Rhizoctonia solani*) were published in *Phytopathology* for August, 1930, under the title "The effect of air temperature on the pathogenicity of *Rhizoctonia solani* parasitizing grasses on putting green turf." Field observations again verified the results obtained in previous years, and each attack of the disease was accurately forecast during the 1930 season.

Further progress has been made in the use of fertilizers to maintain healthy turf during periods of extreme drought, especially where artificial watering is impractical. It appears that certain combinations of fertilizers can offset to a considerable degree the disadvantages of a dry season and produce excellent turf.

Studies in the control of mouse-ear chickweed (*Cerastium vulgatum*) and

pearlwort (*Sagina procumbens*) have been started and should prove of value to growers of fine turf.

The series of plots established in cooperation with the United States Golf Association is furnishing data particularly valuable to golf-course management and of equal use to cemetery and park superintendents. The soil of the plots is of clay loam, thus furnishing unusual opportunities for observations concerning earthworms and the growth of grass as affected by the compactness of the soil. These plots are also giving information regarding the effect of fertilizers on weed invasion.

Several additional species of grasses have been placed in the trial plots.

DEPARTMENT OF PLANT AND ANIMAL CHEMISTRY

J. B. Lindsey in Charge

The Effect of Fertilizer and Cultural Treatment on the Nitrogenous Compounds of Havana Seed Leaf. (E. B. Holland and E. Bennett). Analytical work on the several grades of Havana tobacco grown on the experiment station plots under different fertilization and cultural treatment has been continued. The plants were harvested at different stages of growth, cured on the stalk, stripped and sorted. After the midrib and several coarse laterals had been removed, the residual web was ground and analyzed, with attention directed largely to the nitrogenous compounds. In many instances the number of replications was insufficient to establish a positive trend. Furthermore, seasonal variations in growth and curing and possible differences in drawing and sorting small samples have to be considered. The following deductions seem warranted.

(1) The percentage of total, soluble, and amido nitrogen increased in the several grades from the base of the plant upwards; the nicotine increased from the base of the stalk to the light or medium wrappers, and the acid soluble and insoluble ash decreased.

(2) Low topping increased the percentage of total nitrogen, soluble nitrogen, nicotine and acidity in seconds and reduced the acid soluble and insoluble ash.

(3) The percentage of total, soluble, and ammoniacal nitrogen, acid soluble ash and acidity decreased with maturity in seconds and darks, while nicotine and insoluble ash increased.

(4) An increase in applied nitrogen increased total nitrogen, soluble nitrogen and acid soluble ash within narrow limits, but as a whole affected the yield and size of leaf rather than composition.

(5) Nitrate of soda and sulfate of ammonia increased the total nitrogen in seconds more than the regular tobacco fertilizer mixture or cottonseed meal. Nitrate nitrogen and nicotine were low on cottonseed meal. Sulfate of ammonia increased acidity as would be expected, and nitrate of soda gave the least acidity.

(6) Timothy in the rotation increased the percentage of soluble nitrogen, ammoniacal nitrogen, nicotine and acidity and reduced the percentage of acid soluble ash.

(7) Continuous tobacco gave a slightly higher percentage of total, soluble, and ammoniacal nitrogen, acid soluble ash and higher pH than tobacco following onions or potatoes.

In addition to the chemical studies here reported, the yield, grades, and market value of Havana tobacco grown on the experiment station plots under different fertilization and cultural conditions have been compiled.

Oil Sprays. (E. B. Holland). The preparation of numerous miscible oils and stock emulsions with diamond paraffin oil (a light lubricating oil) and different emulsifiers has been continued and the stability against stratifying and breaking on test noted. The work is time consuming as it is largely on a trial and error basis[1]. As a whole the miscible oils prepared by spontaneous methods are the most promising, easy to make, and relatively inexpensive. The laboratory samples applied last spring gave satisfactory results in the field.

The work should be continued with a medium paraffin oil.

Nitrogen Fixation in the Presence of or as a Result of the Growth of Legumes versus Non-Legumes under Certain Defined Agronomic Conditions. (F. W. Morse). This year (1930) all the plots were seeded with Japanese millet. Conditions were favorable for uniform growth until July 22, when a short, severe thunderstorm beat down the millet on the plots fertilized with nitrogen, which inhibited subsequent growth up to the date of cutting (August 19) and also caused a heavier stubble to be left on the field.

A comparison of the annual production with and without nitrogen for both systems of cropping is presented for this and the preceding years. The plots selected for comparison are adjacent to each other; Plot 9 which has not received nitrogen since 1882 and Plot 10 which has received organic nitrogen throughout the period. During this study the applications of nitrogen have been made in alternate years, 1924, 1926, 1928, and 1930. Plot 10 received a total of 80.9 kilograms of nitrogen per acre in the form of dry ground fish.

Scanning the results with leguminous crops used in rotation, it will be noted that clover did not respond to the use of nitrogen in the fertilizer whether applied directly as in 1924 or the previous year as in 1929. Soy beans, however, did respond to the direct application of nitrogen in 1926, especially in the amount of nitrogen recovered in the crop. Corn was grown in the years when nitrogen was withheld, but showed some gain due to the previous season's application. Millet in 1930 received a direct treatment with nitrogen and responded, especially in the yield of nitrogen in the crop.

The results with continuous non-leguminous crops show very plainly their response to applications of nitrogen in the fertilizer.

The objective of the experiment, however, was to ascertain whether or not there was fixation of nitrogen in the soil in the absence of leguminous plants. It will be noted that as the years have passed the three kinds of crops, grass, corn, and Japanese millet, without nitrogen, have gained in production of dry matter and yield of nitrogen instead of decreasing as one might expect if no nitrogen was being fixed.

Similar comparative results were obtained with adjoining plots, No. 7

[1] Some ratios seem to indicate that there may be a fundamental reaction involved.

without nitrogen and No. 8 which received 80.9 kilograms of nitrogen per acre in sulfate of ammonia.

It is planned to continue the investigation.

LEGUMINOUS CROPS GROWN IN ROTATION

(Kilograms of Dry Matter and Nitrogen removed per Acre)

Year	Crop	Without Nitrogen		With Nitrogen	
		Dry Matter	Nitrogen	Dry Matter	Nitrogen
1924	Clover	1866	49.8	1792	46.5
1925	Corn	1766	29.8	1816	31.3
1926	Soy Beans	1596	39.9	1860	50.0
1927	Corn	1164	18.5	1310	23.0
1928	Clover and Weeds	1334	18.9	1340	17.1
1929	Clover	1852	41.9	1714	37.9
1930	Millet	2575	32.7	3011	43.2
	Total	12153	231.5	12843	249.0
	NON-LEGUMINOUS CROPS GROWN CONTINUOUSLY				
1924	Grasses	496	4.6	1393	10.1
1925	Corn	1010	13.1	1280	18.5
1926	Millet	2126	14.0	4286	36.5
1927	Corn	1294	21.5	1258	22.8
1928	Grasses and Weeds	1478	13.2	1846	17.9
1929	Grasses	617	6.0	1055	10.8
1930	Millet	3066	29.3	2984	40.6
	Total	10087	101.7	14102	157.2

Chemical Study of Cranberries. (F. W. Morse). The work of the last four years has been issued in Bulletin No. 265, "A Chemical Study of Cranberries".

Milk Substitutes in the Growing of Young Calves. (J. B. Lindsey and J. G. Archibald). For a part of the year 1929 and during 1930 studies have been in progress of a system based largely upon dry feeding, no liquid except water being fed after the first few weeks.

The first group of nine high-grade Holstein calves, five bulls and four heifers, was fed on the so-called New Jersey ration consisting of whole milk for three weeks, decreasing the same during the fourth week so that at the beginning of the fifth week the calves were receiving only dry feed, consisting of alfalfa for roughage and a grain mixture containing some 12½ per cent of soluble blood flour. The calves did fairly well and averaged 231 pounds (200-287) in weight at four months of age, making an average daily gain of 1.15 pounds.

A second group of five calves, three bulls and two heifers, was fed in the same way, except that rowen was fed in place of alfalfa. They averaged 228 pounds (210-238) in weight at four months of age, with an average daily gain of 1.12 pounds.

A third test is now in progress in which white fish meal was substituted for the blood flour. The calves did not take to the grain ration as readily because of the odor of the fish meal. Three records have been completed and two others are in progress. The three completed records show an average weight of 227 pounds at four months of age and an average daily gain of 1.02 pounds.

While it is possible to grow Holstein calves by the dry method of feeding, it is not to be commended. Most of the calves appeared thin, "pot bellied," and not in as satisfactory condition as those receiving a portion

of natural skim milk or diluted skim milk powder until four months old. It is believed that very young calves should be given a vigorous start by feeding some form of milk as a part of the ration until they are at least four months of age. (See Bulletin 253 of this Station). They should not be converted into cud chewers too early.

Mineral Requirements for the Growth of Dairy Heifers. (J. B. Lindsey and J. G. Archibald). A study of the calcium requirements has been completed, using eight high-grade Holstein heifers. They were divided into two groups; one was fed a ration high in calcium while the ration for the other group was low in calcium. The average age of the heifers was 140 days at the beginning and 858 days at the end of the experiment, or time of calving. The ration for the high-calcium group consisted largely of alfalfa hay, together with dried beet pulp and a grain ration made up mostly of corn meal; for the low-calcium group hay of mixed grasses (with 30 per cent alfalfa during the first period), dried apple pomace, and corn and linseed meals. Seventy-six satisfactory metabolism balance trials were completed. The detailed data and discussion of results have been prepared for publication and sent to the *Journal of Agricultural Research.*

The results, as a whole, point to accumulation of a considerable reserve of all elements by the high-calcium group during the first year and a lowering of retention later on. The low-calcium group, on the other hand, not having accumulated such a large reserve in the earlier stages, must have felt the need of more calcium and made the effort to utilize it to a greater degree in the third year.

BALANCE RECORD OF RETENTION FOR EACH GROUP DURING THE ENTIRE EXPERIMENT

	Daily retention		Daily retention per 100 lbs. live weight		Retention percentage of intake	
	High calcium group	Low calcium group	High calcium group	Low calcium group	High calcium group	Low calcium group
	Grams	*Grams*	*Grams*	*Grams*	*Per cent*	*Per cent*
Nitrogen	25.49	18.73	3.49	2.88	21.12	18.20
Calcium	7.74	4.45	1.06	0.68	17.76	21.60
Phosphorus	3.52	2.15	0.48	0.33	27.36	14.83
Magnesium	0.22	—0.48	0.03	—0.07	1.42	—3.18

The establishment of approximately a 2 to 1 ratio between the amounts of calcium and phosphorus retained, irrespective of the ratio in the intake, was very uniform in both groups and at all ages.

The records of weight and height at withers did not show that one group made any better growth than the other, in spite of the larger assimilation of the elements by the high-calcium group. On the basis of the results secured, it would seem to be a reasonable conclusion that heifers can make satisfactory growth on rations supplying approximately 4.5 grams of calcium daily during the first year of life, 3 grams daily during the second year, and 2.5 grams daily during the third year, for each 100 pounds of live weight. A good quality of hay with 30 per cent of legume hay or rowen during the first year will supply these amounts, while legume hay for roughage will be necessary to supply such amounts as were retained by the high-calcium group.

Two Systems of Dairy Cattle Feeding—High Roughage and Low Grain versus Low Roughage and High Grain. (J. B. Lindsey and J. G. Archibald). This project was organized and started in the autumn of 1928 and is intended to continue for at least three years. The object has been to make careful observations, under controlled conditions, of the effect of maximum roughage and low grain (1 pound to 4½ pounds milk) fed to one group of cows, and minimum roughage and high grain 1 pound to 2½ pounds milk) fed to another group, upon the economy of milk production and the condition of the cows as regards appearance, live weight, and breeding. The roughage has consisted of first cut hay, rowen, silage, and green forage fed in different amounts; and the grain, of a mixture of wheat bran, ground oats, corn meal, gluten feed, and cottonseed meal, mixed in different proportions for the two groups.

The results for the first year ending in October, 1929, showed very little difference between the two groups. At this writing, data for the year ending October, 1930, have not been completed.

The Chemical Composition of Grass from Plots Fertilized and Grazed Intensively. (J. G. Archibald). Results for 1929 have been published in the *Journal of Agricultural Research,* Vol. 41, No. 6, for September 15, 1930.

The fertilizer treatment decreased considerably the dry matter content of the grass and the crude fiber content of the dry matter. All other constituents of the dry matter that were determined were increased, the nitrogen showing the most significant rise. Acre production or recovery of all constituents was increased, nitrogen being nearly double that recovered on the check plot. The effect of withholding nitrogen from one plot was very marked.

The conclusions reached in the earlier publication (see Annual Report for 1929) regarding (1) increase in nutritive value due to fertilization, (2) absence of any appreciable effect of the treatment in leveling seasonal fluctuations, and (3) changes in chemical composition of the grass as the season advanced are substantiated and strengthened by the results of 1929.

A careful study of all results for both seasons (1928 and 1929) and correlation of these with the weather records leads to the further conclusion that of all the factors influencing the chemical composition of grass, producing as they do marked seasonal fluctuations, the amount of rainfall is the most important.

The study has been continued during 1930, but results are not yet available. It is planned to bring this phase of pasture grass studies to a conclusion with the publication of the present season's results.

As an outgrowth of the above study and in response to a demand for more fundamental information on pasture problems, a more complete project entitled "Studies in the Chemistry of Pasture Grass" was organized early in the year. The objective in this project is to ascertain the fundamental chemical facts which agronomists and animal husbandmen need as a basis from which to start in their study of the agronomic and nutritional phases of the problem, and upon which to base recommendations in practice.

In connection with this work 154 samples of pasture grass have been collected during the past season, and analytical work at date of writing (December 16, 1930) is about half completed.

DEPARTMENT OF POMOLOGY

F. C. Sears in charge

The yield of apples and peaches from the station orchards in 1930 was by far the largest in recent years. The quality was also good. Bloom was heavier than usual, and the crop harvested was more than twice that of last year.

The Interrelation of Stock and Scion in Apples. (J. K. Shaw and J. S. Bailey). The usual observations of growth, bloom and yield have been continued. In some parts of the orchard the trees are crowding each other, and a general thinning out of the orchard is necessary. The results of this work suggest that root influence is more likely to dwarf a variety than to invigorate it. The results from the main orchard have been summarized and will soon be prepared for publication.

The young orchard of McIntosh and Wealthy set in 1928 has made a good growth and shows that the East Malling Stocks have a strong influence on growth. The trees are much dwarfed by stocks 8 and 9, while 12 and 16 have thus far developed trees equal in vigor to budded or own-rooted trees. The two varieties are influenced about alike except that there is a striking difference when propagated on stock No. 1, which dwarfs the Wealthy distinctly while McIntosh makes a fairly vigorous tree.

Root cuttings from five-year-old Malling Stocks gave poor results, while scions grafted on nurse roots started well, as did rooted layers. An effort is being made to increase the supply of these Malling Stocks.

Tree Characters of Fruit Varieties. (J. K. Shaw and A. P. French). Work on this project has continued both in Amherst and in various nurseries. A nursery containing nearly 150 varieties of apples, including all varieties commonly grown by nurserymen, has been established. Detailed observations and photographic records will be made. The leaders of this project have continued the work of certifying varieties in certain nurseries for several years. Recently the practice of examining all trees when one year old has become established. Thus the propagation of mixtures is avoided and the stock in these nurseries is now almost free from misnamed trees.

The Genetic Composition of Peaches. (J. S. Bailey). No additional crossing work was done in 1930. Of the 1260 seedling trees from previous work in the orchard, 717 fruited for the first time. Of those fruiting, 289 seedlings are crosses and 428 selfed. The fruits of 275 seedlings are white fleshed and of 442 yellow fleshed; 119 are clingstones, 22 semicling, and 576 freestones. Fifty-three seedlings are considered worthy of further observation. Yield was better in the higher parts of the orchard where more fruit buds survived the winter. Hence yield was more dependent on hardiness and location in the orchard than on inherited ability to form fruit buds.

Although one year's results are not enough to draw conclusions from, yet certain statements can be made when the results check with the work of other investigators. The reniform type of foliar glands is dominant, glandular is recessive, and globose is intermediate. White flesh color is dominant, and yellow recessive. Belle is a heterozygous white. Hale,

Chile, Gold Drop, Crosby, Fitzgerald, and Elberta seem to be fairly homozygous for ripening date, while Belle and Champion are heterozygous. Vainqueur, Greensboro, and Carmen seem to transmit earliness in crosses. A character for very tough flesh appeared in the selfed progeny of Champion and Belle. It appears to be recessive.

The work with the freezing apparatus was continued. Not enough data have been obtained to draw conclusions, but length of exposure to cold and previous exposure to high or low temperatures seem to be important factors in influencing the killing temperature, as well as rate of temperature fall. Lowering the temperature to near the killing temperature and then holding it there for twenty-four hours offers some promise as a method for determining the relative hardiness of varieties and seedlings.

Testing Methods of Pruning. (J. K. Shaw). The project with young bearing trees has been carried on as before. The weights of prunings and growth, bloom and yield were recorded. No new or striking results have appeared, and at present it seems that this experiment suggests lessened rather than increased importance of pruning. While the pruning of bearing apple trees will doubtless be continued, its effect on the crop is probably far less than that of soil management or spraying.

Effect of Pruning on Bearing Apple Trees. (W. L. Cutler). This experiment on trees now forty years old is in its fourth year. No striking differences in size, color, or quality of the fruit have yet appeared. The evidence now available indicates that heavy pruning has, on the whole, decreased yields; and that light pruning may have given somewhat greater yields than no pruning.

Comparison of Cultivation and Sod in a Bearing Orchard. (J. K. Shaw). This experiment has continued as in the past four years. The cultivated plots without fertilizer gave a fair crop of high color this year, yet much less than fertilized plots. The highest yield for the four-year period has been from the cultivated plot receiving nitrogen, but the color is not quite as high as that from the sod-nitrogen plot. There seems to be a benefit from the addition of potash to nitrogen on sod plots, but as this potash plot has always yielded more than the one without nitrogen a careful analysis of more data is needed before final conclusions may be drawn.

Comparison of Clover Sod and Grass in Sod Mulch Orchard. (J. K. Shaw). The white clover on the potash-phosphorus-lime plots continues to increase, but the yields of apples are still better on the nitrogen-phosphorus-potash plots. Determination of nitrates in soil from clover patches and from adjoining grass areas gave at no time higher nitrates in the clover. Growth and yield have been better on the clover plots than they were on nearby unfertilized sod plots.

Tests of Different Amounts of Nitrate of Soda. (J. K. Shaw). The Baldwin trees in sod receiving 10, 17½ or 25 pounds of nitrate of soda gave a heavy crop this year. The color was inferior, but there was no difference between lots that had received different amounts. It is now planned to apply nitrogen in the non-bearing year only for a period of years to see whether color is improved and yields maintained.

Comparison of Cultivation and Heavy Mulching for Apples and Pears. (J. K. Shaw). The mulched plots continued to yield heavily, the McIntosh trees averaging nearly 30 bushels per tree while one tree yielded a total of 48 bushels. This comparison has continued for eight years and

seems to have demonstrated the superiority of heavy mulch over cultivation, both being without added fertilizer. It is planned to make some change in the test as it has been proved that a program of cultivation without fertilizer will not maintain production on this soil.

The Effects of Fertilizer Limitation on Fruit Plants. (J. K. Shaw). The fruit plants (apple, peach, grape, raspberry) that have been on this experimental field were removed in the spring of 1930. The fertilizer treatment was continued, and a crop of buckwheat grown and not removed. It is planned to reset the field in the spring of 1931 to own-rooted trees. These field plots with their long-continued fertilizer treatments serve as a source of soil for certain pot experiments.

Role of Potash and Lime in Fruit Tree Nutrition. (J. K. Shaw). A set of pot cultures similar to those of last year but with different fertilizer treatments were grown. Applied nitrates increased growth only to a small degree. Magnesium-free calcium carbonate was as effective without as with added magnesium sulfate. It seems clear that this soil having a pH value of about 4.75 is too acid for the best growth of fruit plants.

Effect of Potash and Lime on Apple Trees. (J. K. Shaw). This project has been carried on without change. Determinations made at several times during the summer showed that soil nitrates were present on plots receiving no nitrogen-carrying fertilizer and also on some of the plots receiving nitrogen, though most such plots showed rather small concentrations at times. No nitrates were present on white clover areas on the phosphorus-potash-lime plot.

Study of Varieties of Tree Fruits. (J. K. Shaw and O. C. Roberts). The station continues to add new and promising varieties of fruits to its test orchards. All the more prominent "bud sports" of apples are under observation. There was an excellent crop on the new peach varieties received from the New Jersey Experiment Station. Most of these are promising and merit a trial by Massachusetts growers. There seem to be among them varieties that are worthy to replace most of the varieties now commonly grown with the exception of Elberta. The Ideal peach of New Zealand, received from the United States Department of Agriculture, gave a heavy crop of attractive peaches that seemed promising for home canning. The Newburgh raspberry, originated at the New York Experiment Station, gives promise of being a desirable mosaic-resistant variety. The Macoun apple seems to be a variety that should be tested generally in Massachusetts orchards.

Fruit Bud Formation in the Strawberry. (R. A. Van Meter). This project was carried out as outlined in the last report and a new bed, with some modifications of treatment, set for fruiting in 1931. This bed includes fertilizer treatments as follows:

1. No nitrogen
2. August 15, nitrate of soda
3. August 15, sulfate of ammonia
4. August 15, urea
5. September 15, nitrate of soda
6. September 15, sulfate of ammonia
7. September 15, calurea
8. October 1, sulfate of ammonia
9. October 15, sulfate of ammonia

All plots are in quadruplicate and received applications of phosphorus and potash.

Three series have been added with treatments of phosphorus, phosphorus-potash and no fertilizer.

Bud Mutations Among Apples and Other Fruits. (B. D. Drain and W. H. Thies). A considerable number of selections from bud sport limbs and prospective mutation strains were made during the past year, and top grafted into trees of bearing age. These grafts grew nicely during the past season.

Light Pruning of Young Grape Vines. (B. D. Drain). The work of this project has been carried on for three years, with results similar to those reported in 1928. Leaf area measurements show a much larger leaf area on the light pruned vines.

Work not on a Project Basis. As in previous years considerable work, not formally organized on a project basis, has been carried on. This is either of a temporary nature or is preliminary to project organization. Some of it is carried on by members of the department not officially members of the Station Staff.

The "Set" of McIntosh Apples in Middlesex and Worcester Counties. This problem largely disappeared in the season of 1930 when most orchards set and matured good crops. It will doubtless return in later years, for the peculiarity of the variety will not change. Cooperative tests were carried out by some fourteen growers to learn something of the response of their orchards to certain treatments, mostly varying fertilizer and cultural treatments.

Blueberry Culture. (J. S. Bailey). For several years some work has been carried on with blueberries. This has been largely on propagation. One of the greatest difficulties in developing blueberry culture is the high cost of plants due to a lack of general knowledge of successful methods of propagation. Cuttings have been grown in ordinary cold frames and in a solar frame. Some progress has been made, and it is hoped that in the near future it will be possible to grow plants from cuttings with good success.

A Study of the Storage of McIntosh Under Various Conditions. (O. C. Roberts in cooperation with the Agricultural Engineering Department). This is the second year of this cooperative investigation of the most desirable storage conditions for McIntosh apples. Similar lots of McIntosh apples were stored at temperatures ranging from 45° F. to 32° F. After approximately two months, samples of each lot were transferred to 32° F. Periodical observations and tests were made to determine the condition of each lot.

The project has been extended to include a comparison of the blower type of refrigeration with the common direct expansion system with pipes extending along the walls. Samples of McIntosh apples were stored in various farm storages equipped with blowers, and duplicate lots were stored in the Nashoba cold storage at Ayer. Periodical observations were made and changes noted. Accurate data relative to the conditions in the various storage houses were also collected at frequent intervals.

Test of Spray Materials. (O. C. Roberts). Constant effort is being made by manufacturers and experiment stations to discover new materials and combinations which will enable the fruit grower to control the numer-

ous pests in his orchard without causing injury to the trees or fruit. In order that the effect of these materials may be determined for Massachusetts conditions, the Departments of Pomology and Entomology cooperating have made field tests of a few of those materials which have appeared to be of particular interest to Massachusetts fruit growers. Details of these tests are given in the report of the Department of Entomology.

Studies of Arsenical Residue on Apples. (O. C. Roberts). For the past four years a study of the amount of arsenical residue on apples as related to different spray schedules has been conducted by the Departments of Pomology and Entomology and the U. S. Food, Drug, and Insecticide Administration at Boston. This experiment is discussed in the report from the Entomology Department.

Cross-Pollination and Sterility Studies with Certain Apple Varieties. (F. C. Sears and O. C. Roberts). For the past six years the Pomology Department has been making a study of the effects of pollination on the set of fruit. Particular attention has been given to the McIntosh, the most important variety in Massachusetts. McIntosh is practically self-sterile, but appears to be a good pollenizer for other varieties. A few of the most reliable pollenizers for McIntosh are Wealthy, Delicious, Oldenburg, Ben Davis, and Cortland.

Pruning of Northern Spy Trees. (O. C. Roberts). In 1927 the trees in a small block of young Spy trees were divided into three groups. Each group has since been given different pruning treatments as follows: (1) Unpruned, (2) Heavy pruned, (3) Branches spread and lightly pruned. These trees have just begun to bear, so data on the effect of the various treatments on quantity and quality of fruit are as yet very limited. However, there seems to be an indication that the trees with branches spread and lightly pruned are more desirable than the others.

DEPARTMENT OF POULTRY HUSBANDRY

J. C. Graham in charge

Broodiness in Poultry. (F. A. Hays). Progress is being made in establishing a non-broody and an intense broody line of Rhode Island Reds. A pen of 13 hens in the non-broody line ranging in age from two to five years was given access to open nests from April 20 to August 1, 1930, in studies on the effect of management upon broody behavior. Non-broody birds are being tested genetically for the complementary genes responsible for broodiness.

The intense broody line is being studied, with special reference to the inheritance of degrees of broodiness measured by number of broody periods. The non-broody and the intense broody lines are being developed with special reference to uniformity in other inherited characteristics, in order that the effects of broodiness may be accurately determined.

Breeding Poultry for Egg Production. (F. A. Hays and Ruby Sanborn). The mean annual production of the 352 birds hatched in 1928 was 221.4

eggs, an increase of about 16 eggs over any previous flock. This increase was brought about by superior intensity and greater persistency in the flock as a whole. Special attention is being given to improving egg size, reducing mortality rate, and eliminating winter pause. Mean egg size is improved, and the mortality rate for the 1928 flock for the full laying year was 14.85 per cent. Hatching records for the entire flock for the spring of 1929 show 77.7 per cent of fertile eggs hatched; for the spring of 1930 the figure was 74.5 per cent. These hatching records show progress, and include only eggs hatched under conditions used in pedigreeing.

Statistical Study of Heredity in Rhode Island Reds. (F. A. Hays and Ruby Sanborn). Annual molt records from 1917 to 1928 were studied statistically and published in Bulletin 264. A paper on linkage relation for genes concerned in fecundity and genes concerned in egg size was prepared for the 4th World's Poultry Congress in London, July, 1930. Studies on time required for pullets to attain standard egg weight were reported at the 1930 Poultry Science meeting at Macdonald College.

A Genetic Study of Rhode Island Red Color. (F. A. Hays). In this experiment three strains are being developed: One is made up of pure Station stock selected for good color, a second consists of birds true to Standard from an outside source, and the third is made up of hybrids of the other two strains.

Determination of Genetic Laws Governing Results in Inbreeding Poultry. (F. A. Hays). Results of this project up to 1929 were reported in Bulletin 258. In the spring of 1929 the method of experimentation was changed somewhat in that the more rigid standards for selecting foundation breeding stock for high fecundity were employed. A new generation was established in 1929 in a special effort to avoid any inherited characteristics inimical to high fecundity. The second generation was produced in the spring of 1930 from half-brother and sister matings.

Heredity and Environmental Characteristics Affecting Variability in Egg Production. (F. A. Hays). The third generation of pullets in this experiment is now being tested for egg production. There are three rather distinct lines represented with respect to characteristics affecting fecundity. Data should be adequate for publication at the close of the laying year in 1931.

Factors Affecting Egg Weight and Shell Character in Domestic Fowl. (F. A. Hays). Complete egg weight records from first pullet egg to January 1 are available on 2100 birds hatched in 1927, 1928, and 1929. Records on the weight of every egg laid by 500 females during their first laying year are also available. The third generation of birds in the small, medium and large egg groups was hatched in 1930. Sufficient data should be available for publication at the close of 1931. The application of methods already reported has produced improvement in egg size for the flock as a whole.

Relation of Intensity or Rate of Laying to Feather Pigmentation. (F A. Hays). Results of this project are being prepared for publication.

DEPARTMENT OF VETERINARY SCIENCE

J. B. Lentz in Charge

Poultry Disease Elimination Law. (H. Van Roekel, K. L. Bullis, G. L. Dunlap, and O. S. Flint). The progress made in pullorum disease eradication during the 1929-1930 season is reported in Control Series Bulletin No. 53. Approximately one-seventh of the poultry population of Massachusetts was tested and the volume of work is steadily increasing. Compared with the previous season the following increases are noted:—48 tested flocks, 76,802 tested birds, 82,590 tests, 81 negative flocks, and 53 non-reacting 100 per cent tested flocks. Further comparison shows that the average percentage of infection was reduced from 4.25 to 2.35 per cent.

A study of 60 flocks tested for two consecutive years showed that intensive retesting or short-interval testing was more effective in eradicating the disease than annual testing. Similar results were obtained in 30 flocks tested for three consecutive years.

The relation of sexual maturity to pullorum disease eradication was studied in ten flocks which were subjected to the intensive testing plan. The results show that sexual maturity of pullets does not appear to play a role in eradicating the disease. From an eradication point of view, early pullet testing in infected flocks is more desirable than testing more mature birds.

Failure in eradicating the disease or in maintaining a pullorum disease free flock was in most instances due to a lack of observing sound eradication measures. More effective results would be obtained if all poultrymen would follow the laboratory suggestions more closely.

Two hundred and twenty-eight reacting birds were submitted to the laboratory for necropsy. The necropsy findings often aided in establishing the true status of a flock. No reactors were detected among the 584 tested fowl other than chickens.

This laboratory again participated in the annual pullorum conference of the Eastern States' laboratory workers. The purpose of this conference is to standardize and adopt uniform, sound methods which will prove practical and effective in pullorum disease eradication.

Among the blood samples submitted since August 1, 21,123 samples, representing 37 flocks, were tested with *Brucella abortus* antigen in 1-25 and 1-50 dilutions. All samples were considered negative.

An effort was made to determine the length of time *S. pullorum* will remain viable under various conditions. It was observed that the organism can remain viable on a dry piece of cloth in a Kolle flask for fourteen weeks and possibly longer.

The problem of "jelled serum" samples is being investigated. Results thus far show that the number of jelled samples may be greatly reduced if the freshly drawn blood is not subjected to low temperatures.

Laboratory Service—Pathology. (G. L. Dunlap). This service was used by 352 people, 71 making personal calls to deliver specimens or discuss poultry diseases. Ten hundred and seventy-nine specimens were examined, of which 1016 were poultry, the remainder consisting of other

domestic and semi-domestic animals. Approximately 15 per cent of all poultry examined were infested with parasites, led by coccidiosis, with tapeworm infestation second. Avian tuberculosis was diagnosed on two farms. Fowl cholera and fowl typhoid were not encountered.

An especially virulent strain of *S. pullorum* was isolated from mature stock and studied. This culture was physiologically and serologically identical to stock strains of *S. pullorum*. It produced death in two birds injected intravenously with 0.2 cc. of broth culture in 17 and 18 days, respectively, and the organism was again recovered. Two birds inoculated intratracheally with 0.5 cc. of broth culture were made visibly sick for a period of a week, but recovered. The primary lesion produced in these cases was a pericarditis.

A group of 25 day-old chicks were fed mash, which was contained in a bag contaminated with *S. pullorum*, for a period of three weeks. No mortality occurred from pullorum disease. At six weeks of age the agglutination test revealed two reactors. No more reactors were detected by the agglutination test applied at one and two weeks intervals over a period of seven months. *S. pullorum* was isolated from one of the two original reactors which were detected at the age of six weeks.

Farm and Station Bang's Disease. The laboratory, in assisting this project, has recorded 1339 agglutination tests.

Infectious Trachitis in Poultry. (C. S. Gibbs). Progress has been made in the study of infectious trachitis. The disease has been found to be caused by a filtrable virus. The virus has been demonstrated in the tracheal exudate and in the secretions from the kidneys of diseased birds. Some of the birds recovering from infectious trachitis have been found to persist as apparently healthy immune carriers. The viability of the virus is prolonged by freezing and drying.

Studies on secondary invaders in infectious trachitis have been made, and a laryngo-tracheal spirochete has been discovered. As far as is known at this station, this microorganism has not been observed before in poultry in the United States.

Details of these investigations are being prepared for publication.

THE WALTHAM FIELD STATION

(Waltham, Massachusetts)

Ray M. Koon in Charge

For reports on experiments conducted at this substation in addition to these listed under the Waltham Field Station, see reports of the Departments of Botany, Entomology and Floriculture.

The Plant House. (P. W. Dempsey). Experiments have been continued in the construction, heating and operation of a sash-covered plant house. A twelve-sash hotbed was added to the plant-house model and one hot-water heater was used as a source of heat for both. This arrangement proved more satisfactory than using horse manure for hotbed heat. The interest in the plant house is indicated by the fact that 500 copies of plans and specifications have been sent out in response to requests for information.

Electric Hotbed. (P. W. Dempsey). After investigating the practical application of electricity for heating hotbeds in 1928, it was decided that the expense was too great, both for installation and upkeep. During the past year, however, the General Electric Company has introduced a new type of heater and thermostat, economical both in operation and cost. Plans are in the making for operating three hotbeds of four sash each with manure, hot water and electricity as sources of heat, in co-operation with the Edison Electric Illuminating Company of Boston. Notes on the comparative cost, temperature and other details will be kept.

Vegetable Variety trials. (P. W. Dempsey). Twelve varieties and strains of pole beans were tested. Kentucky Wonder proved to be the best both for the market and for home growing. The new variety of Italian Pole may replace the Kentucky Wonder because of its superior quality.

Seed of twelve strains of Calabrese broccoli were secured from as many different seedsmen. A decided uniformity was noted in all samples.

Thirty-seven strains and varieties of sweet corn were tested. Golden Sunshine was the outstanding early yellow variety and shows promise of replacing the once popular Golden Bantam. Golden Gem, a production of the North Dakota Experiment Station, is a very early yellow sort but too small to justify its extensive use for home or market planting.

Twelve varieties of peppers were compared. California Wonder, a new introduction, shows up well and is becoming popular with the growers. Red Sport of Oshkosh (seeds sent to Dr. Guba of this Station in 1929 by a private grower) shows great promise, and a separate plot will be devoted to this variety in 1931 for the purpose of further selection if the variety seems worthy.

Twenty varieties and strains of staked tomatoes, and fifty-four varieties and strains grown flat culture, were studied. There was no outstanding strain or variety.

Six strains of the popular Straightneck variety of summer squash were planted. No strain yet tried runs more than 50 per cent true to type.

Twenty strains and varieties of beets were seeded in two plantings. A great improvement has been noted in the strains of Detroit Dark Red offered by seedsmen the past three years. Crosby's Egyptian, however, remains the most popular and undoubtedly the best variety for Massachusetts growers.

Forty-nine strains and varieties of lettuce, of two plantings each, were made. The best lettuce ever produced at the Field Station was at just the right stage of maturity for Field Day. Many growers were impressed with the new strains of the so-called "White Big Boston" now sold by seedsmen under several names. It appears to be worthy of trial by any grower for sowing at any time during the season.

Conditions Affecting the Production and Vegetative Propagation of Washington Asparagus. Depth of Planting. (P. W. Dempsey). In 1928 two hundred selected one-year roots were planted two, four, six and eight inches deep. Next spring the beds will be cut for the first time.

Depth of Planting	No. of Plants	No. of Stalks	Average Stalks per plant
2	192	1700	8.8
4	197	1551	7.8
6	175	1209	6.9
8	154	1057	6.8

Fertilizer Studies. (R. M. Koon). The plots are located at Waltham, Concord and Eastham. Five acres, in total, are devoted to the plots. A comparison of fertilizer ingredients, time of application of fertilizers, amounts of fertilizer to apply, relation of high phosphoric acid to maturity, and relation of fertilizer to earliness are the principal problems being investigated. Although there were variations between the plots at the end of the 1930 season, there was no correlation between the variations and the treatment of the plots. This experiment will continue until 1934.

Greenhouse Lettuce. (V. A. Tiedjens). Very favorable reports from growers who tried out the Bel-May lettuce in the spring of 1929 resulted in a demand for seed. The Boston Market Gardeners Association sent one-half pound of the foundation stock to a California seed grower who returned 60 pounds of seed last August for distribution among the lettuce growers of this State. One-half of the lettuce produced in the greenhouses of Massachusetts during the season of 1930 is of the new Bel-May cross. It is a superior hotbed variety and shows promise as a satisfactory sort for the early transplanted crop in the field.

Improvement of Vegetable Varieties through Root and Seed Selection. (P. W. Dempsey). The foundation seed stock of the Field Station Hutchinson Carrot was grown as usual.

Further selection of the foundation stock of the Wyman beet was made, preparatory to having a quantity of seed grown under the supervision of the Oregon Agricultural College in 1931.

F_1 selections of the Blue Hubbard squash selfed in 1929 were planted and several excellent specimens were produced this season. Pollination was continud as before.

Seed from the best strains of Dwarf Horticultural beans from last year's trials as well as special strains from several new sources were planted. A few of the strains which showed some promise were saved for special study.

Perennial Ornamentals. (Ray M. Koon). Perennial gardens have been established for the purpose of observing pest attacks, the effect of cultural treatments, hardiness, and for the benefit of the visiting public who are interested in selecting plant material for their own homes. The plots include 675 varieties of flowering plants commonly known as perennials, 100 varieties of Iris, 60 varieties of roses, and 235 new varieties of peonies from the Cornell Surplus of the American Peony Society. A border of 380 deciduous shrubs and trees of eighty-five different species from which home lovers can make selections for simple and practical landscaping has been planted.

Field Day. The annual Field Day was held as usual at the Waltham Field Station the first Wednesday in August (August sixth) with about 900 market gardeners and florists attending.

COOPERATIVE TOBACCO INVESTIGATIONS

Conducted by the Bureau of Plant Industry, United States Department of Agriculture, in cooperation with the Massachusetts Agricultural Experiment Station. C. V. Kightlinger, U. S. D. A., in Charge

Brown Root-Rot. (C. V. Kightlinger). Experimental work on brown root-rot of tobacco, conducted for the last several years at Whately, was terminated with the procuring of data on the 1929 crop. The results of these experiments will be combined with data from similar experiments conducted in Connecticut, Wisconsin, and elsewhere, for publication as a U. S. D. A. bulletin.

Black Root-Rot. (C. V. Kightlinger). Field experiments were begun this year (1930) at Amherst and at Windsor, Connecticut, to test certain strains of Havana seed tobacco produced by and obtained from Dr. James Johnson of Madison, Wisconsin, to determine their relative type, quality, resistance to black root-rot, and producing capacity under Connecticut Valley conditions. Although not all the data have been obtained yet, some of the strains seem promising. The experiments will be continued until definite information on the matter has been obtained.

Mosaic. (C. V. Kightlinger). Experiments have been carried on for more than a year to determine the extent of overwintering of tobacco mosaic viruses in different kinds of soils, under different conditions of temperature and moisture. All that can be said about results is that a high percentage of infection of mosaic is still being obtained from the materials treated as above described. Another set of similar experiments, begun a year later, is also being carried on for the purpose of verification of results already obtained.

PUBLICATION

Bulletins

260 Annual Report for the Fiscal Year Ending November 30, 1929. 60 pp. March, 1930.

The main purpose of this report is to provide an opportunity for presenting in published form, recent results from experimentation in fields or on projects where progress has been such as to justify the general and definite conclusions necessary to meet the requirements of bulletin or journal.

261 Ecological Studies of the Mexican Bean Beetle. Harvey L. Sweetman and H. T. Fernald. 32 pp. February, 1930.

The Mexican bean beetle was found in Massachusetts and Connecticut for the first time in 1929. A laboratory study of temperature and moisture conditions necessary for the development of the insect is here reported, and the results studied in relation to climatological data for New England. The following conclusions are drawn:

Climatic conditions in the Upper Austral Zone of Massachusetts, Connecticut and Rhode Island are favorable for the development of the Mexican bean beetle, and the insect may therefore be expected to become a serious pest. Conditions in the Transition Zone are less favorable, but the insect will probably become a pest in the lower portion of the Zone, with the injury becoming greatly reduced as the upper limits are approached. The Canadian Zone of New England does not have a physical environment suitable for the development of the beetle. A map of New England showing the three zones is included in the bulletin.

262 Intensive Grassland Management. R. C. Foley, E. J. Montague and C. H. Parsons. 17 pp. February, 1930.

The system of grassland management here reported is based on four distinct principles: (1) Division of area into plots; (2) use of concentrated fertilizers; (3) rotational grazing; and (4) combination of grazing and hay land. The system has been in operation here for two years and in spite of two extreme seasons, the first wet, the second dry, has given excellent results. The second year, in the face of a serious drought, it showed greater returns than the first year, and marked improvement in every respect. This two-year trial has proved that the grazing season may be lengthened and the carrying capacity of a pasture increased by the application of the four principles enumerated above, thus lessening the amount of barn feeding necessary.

263 Food Service in Massachusetts Rural Elementary Schools. Esther Davies. 19 pp. April, 1930.

This survey covered 222 of the 236 towns of less than 5000 population and included 57,600 pupils housed in 800 buildings. Of these, 567 had no food service whatever; 185 had hot drink or soup during the winter only; in 23 a meal was served during the entire school year; and in 23, milk was available for the children during the entire school year. There were 16,000 pupils who must always remain at school over the noon hour, and of these 6000 attended buildings where there was no food service. An examination of 1560 box lunches showed that 93 per cent of the children carrying them had no hot food at noon, and only 15 per cent brought milk. A description is given of eight different types of food service in use in buildings varying from the one-room schoolhouse with practically no facilities to buildings with full meal service. While the type of service which can be offered is limited by the physical equipment of the building, the examples show that no building is too poorly equipped to make some sort of hot food possible, at least during the winter months. Much remains to be done in establishing and improving school lunches; and with the growing tendency toward consolidation of rural schools, the question is becoming of greater importance each year.

264 Duration of Annual Molt in Relation to Egg Production. F. A. Hays and Ruby Sanborn. 14 pp. June, 1930.

A number of factors which may influence duration of molt are considered, as follows: environmental factors, such as hatching date; hereditary characteristics, such as age at first egg, intensity, winter pause, broodiness, and persistency; and physiological activities, such as previous egg production, 365-day production, and gain in body weight during the laying year. Relation of duration of molt to vigor and to second-year production is determined. The study was made with Rhode Island Red birds, and includes all females hatched from 1917 to 1928 and kept for two full laying years. In general, but little correlation was found between duration of molt and the factors studied. Highly intense layers and persistent layers, however, had the shortest molt period, indicating that the physiological process of molting and feather growth took place at a more rapid rate in heavy layers.

265 A Chemical Study of Cranberries. F. W. Morse. 16 pp. October, 1930.

A study of the chemical changes occurring in cranberries while ripening on the vines was made during two seasons. Total sugar was found to increase rapidly as the berries ripen, while total acid remained nearly unchanged. Cranberries do not acquire their maximum proportion of sugar until fully ripe on the vines.

Studies of cranberries in cold storage covered two seasons and showed that they steadily lose sugar by respiration. Total acid decreases also, but at a smaller rate. While cranberries remain sound they contain enough acid to maintain their tart flavor.

In the fall of 1929 there were received from growers in Massachusetts, New Jersey and Wisconsin 116 different lots of cranberries representing 61 distinct varieties. These were analyzed for total acid, total sugar and dry matter. The range in percentages of total acid was from 1.87 to 2.71 and in percentages of total sugar from 2.45 to 5.66. Thirty-five samples contained more than 4.5 per cent of sugar; 49, between 3.5 and 4.5 per cent; while 32 contained less than 3.5 per cent of sugar. The samples lowest in sugar were, as a rule, only partly ripe when harvested.

Ten varieties resisted decay in cold storage to the extent of 60 per cent of sound berries on April 1, 1930; four varieties had all their samples fully half rotted by January 15; and the remaining varieties were in that condition by the end of February.

266 Part-Time Farming in Massachusetts. David Rozman. 44 pp. October, 1930.

A study was made of three representative areas in Massachusetts, and with two main objectives. In Holden, in the central part of the State, the object was to determine the extent of part-time farming in the community as compared with regular agriculture.* Of the 585 families engaged in some kind of farming, only 66 were full-time farmers. Land in crops and total value of products were almost evenly divided between regular and part-time farming. Although the production in most part-time farming enterprises is intended primarily for family consumption, the surplus sold amounted to over one-third of the total value of produce offered for sale by local producers. Part-time farming, therefore, exercised a considerable influence on local prices and marketing conditions of agricultural products.

In the other two areas, four towns adjacent to Lowell and four towns between Taunton and Fall River, the aim was to get a picture of the social and economic status of industrial and other laborers who are engaged in part-time farming. This mode of living was adopted for the most part as a means of increasing earnings and living more cheaply, or in the hope of improved health and better housing for their families. Two main types of part-time farming were found. The greater number had a regular job at which they worked, and did what farming they could in their spare time, with the help of their families. As a rule they raised vegetables or kept chickens or both, and the amount of work required was fairly regular throughout the year. A considerable number, however, engaged in truck farming or small fruit growing, devoting their entire time to it during the season and working at outside jobs only during the months when this type of farming does not require attention.

The development of part-time farming depends upon improvement in transportation facilities, shorter working hours in industry, and the location of industrial plants in small towns and rural communities. Indications are that part-time farming has been increasing in the State during the last decade and that the next ten or twenty years will show a further increase.

267 Hardy Woody Plants. Frank A. Waugh and Charles H. Thompson. 36 pp. October, 1930.

Hardy trees, shrubs, and vines are a very important feature of our civilization. Country roadsides and village streets are planted with trees; parks and playgrounds must have their trees and shrubs; but, most of all, the home grounds are not considered quite respectable unless trees, shrubs and vines are used to soften and civilize the architecture and the topography. Hardy woody plants have been under study for sixty-five years on the grounds of the Massachusetts Agricultural College, and this bulletin is intended to make some of the results of these studies available. A list of over three hundred plants is given, with a brief description of the chief characteristics of each and its performance under conditions found on this campus.

268 Frozen Sweet Cream as an Ingredient of Ice Cream. M. J. Mack. 11 pp. December, 1930.

The storage of cream in a frozen state is a satisfactory way of handling surplus cream for later use in ice cream, the quality of the frozen cream depending upon its initial quality, the length of time held in storage, and the storage temperature. Holding periods of less than six months and storage temperatures below 0° F. are recommended. Frozen cream mixes required a longer time in the freezer to reach a definite percentage of overrun than sweet cream mixes and showed a lower maximum overrun. Frozen cream mixes were higher in viscosity and contained slightly larger and more irregular-sized fat globules and clumps.

Ice cream mixes containing cream frozen with 0.5 per cent gelatin whipped but little better than plain frozen cream mixes. Homegenizing the cream before freezing did not improve its properties for ice cream making. Freezing cream with 10 per cent sugar was the most satisfactory method studied for storing frozen cream for later use in ice cream. The frozen sweetened cream melted more rapidly than plain frozen cream, was lower in viscosity and much more uniform in body. Ice cream mixes made from frozen sweetened cream were superior in flavor to plain frozen cream mixes, whipped considerably faster in the freezer, were lower in viscosity, and contained smaller fat globules and clumps.

269 Packaged Ice Cream. K. E. Wright. 12 pp. December, 1930.

The public has been slow to accept factory-packaged ice cream on account of its lighter weight and poorer texture.

The problem of weight can be most logically solved by drawing the mix at an overrun of about 50 per cent, although the light weight can be partially compensated by increasing the percentage of butterfat or by reducing the price to a weight basis or by a combination of these. Because of the low overrun required in packaged goods, it was found necessary to retard the overrun of easily whipped mixes in order to enable the drawing of the mix at the proper consistency. The substitution of butter for a part of the cream was found to be the most effective practical means of effecting a low constant overrun.

The texture of the ice cream as influenced by freezing was largely determined by the temperature of the semi-frozen product at the beginning of the hardening process. The rate of freezing in the ordinary freezer and in the hardening room was found to be a minor factor in influencing the texture in comparison to the initial hardening temperature. The size of the crystals determining the texture seems to be influenced by a specific range of temperature depending on the mix rather than by a progressive lowering of the drawing temperature of the mix. The results showed that the texture improvement due to gelatin and aging was caused by aging the gelatin, and that the effect on texture was more noticeable when a warm initial aging temperature was employed.

Control Bulletins

53 Tenth Annual Report on Eradication of Pullorum Disease in Massachusetts, 1929-1930. H. Van Roekel, K. L. Bullis and G. L. Dunlap. 23 pp. May, 1930.

54 Inspection of Commercial Fertilizers. H. D. Haskins. 64 pp. December 1930.

55 Inspection of Commercial Feedstuffs. Philip H. Smith. 44 pp. December, 1930.

56 Seed Inspection. F. A. McLaughlin. 42 pp. December, 1930.

57 Inspection of Agricultural Lime Products. H. D. Haskins and H. R. DeRose. 6 pp. December, 1930.

Meteorological Reports

493-504, inclusive. Monthly reports giving daily weather records, together with monthly and annual summaries.

Reports of Investigation in Journals

(Numbered Contributions[1])

101 Mineral Supplements for Dairy Cows. J. B. Lindsey and J. G. Archibald. Jour. Dairy Sci. 13:102-116. March, 1930.

102 Nitrogen Fixation in Field Soil under Different Conditions of Cropping and Soil Treatment. Leon A. Bradley and James E. Fuller. Soil Sci. 30:49-57. July, 1930.

104 The Effect of Initial Cooling Temperature on Gelatin in the Aging of the Ice Cream Mix. K. E. Wright. Jour. Dairy Sci. 13:406-415. September, 1930.

[1] Nos. 103 and 108 were cancelled. Nos. 109 and 110 have not yet been printed.

105 The Effect of Air Temperature on the Pathogenicity of *Rhizoctonia Solani* Parasitizing Grasses on Putting-Green Turf. Lawrence S. Dickinson. Phytopath. 20:597-608. August, 1930.

106 Pasteurized Dried Fruits. C. R. Fellers. Amer. Jour. Pub. Health and Nation's Health 20:175-181. February, 1930.

107 Nitrogen Availability in "Based" and Unbased Ammonium Sulfate and Ammonium Phosphate. A. B. Beaumont and T. R. Swanback. Jour. Amer. Soc. Agron. 22:811-819. September, 1930.

111 The Chemical Composition of Grass from Plots Fertilized and Grazed Intensively in 1929. J. G. Archibald. Jour. Agr. Research 41:491-501. September 15, 1930.

Other Contributions to Journals

(Unnumbered)

The Relation of Weather to the Quality and Price of Massachusetts Onions. R. L. Mighell and H. B. Rowe. Jour. Agr. Econ. April, 1930.

A Study of the Causes of Cull Apples in 1929. W. L. Doran and A. I. Bourne. Mass. Fruit Growers' Assoc. Rpt. 1930.

Effective Control Measures—Oil Sprays: Nicotine Activators. A. I. Borune. Mass. Fruit Growers' Assoc. Rpt. 1930.

Fruit Insect Pests of 1929. A. I. Bourne. Mass. Fruit Growers' Assoc. Rpt. 1930.

European Red Mite in New England Orchards. A. I. Bourne. Fruits and Gardens. March, 1930.

Spraying Recommendations in Relation to Bees. A. I. Bourne. Mass. Dept. Agr. Spec. Cir.

The Plum Curculio as an Apple Pest. W. D. Whitcomb. N. H. Hort. Soc. Ann. Rpt. 30. 1930.

Poisoning Plum Curculio Beetles—Mechanical Barriers of Dust and Spray Residue—Reducing the Cost of Nicotine Sulfate Sprays. W. D. Whitcomb. Mass. Fruit Growers' Assoc. Rpt. 1930.

The Grapefruit and its Juice. C. R. Fellers. The Glass Packer 2:509-510. December, 1929.

Roadside Farm Factories as New Factors in Food Preservation. F. P. Griffiths. The Glass Packer 2:493-519. December, 1929.

Canned Foods Are the Freshest Foods. C. R. Fellers. The Canner 70:17-18. June, 1930.

Utilization of Cold Packed Fruits in Frozen Dairy Products. C. R. Fellers and M. J. Mack. Fruit Products Jour. 9:106-109. December, 1929.

Sodium Benzoate and Benzoic Acid as Preservatives for Cider and Other Fruit Juices. C. R. Fellers. Fruit Products Jour. 9:113-115. December, 1929.

Some Newer Developments in the Control of Apple Diseases. E. F. Guba. Mass. Fruit Growers' Assoc. Rpt. 1930.

Automatic Control of Relative Humidity and Temperature Supplementary to Sash Ventilation in Greenhouses. E. F. Guba. Market Growers Jour. June 1, 1930,

Fundamental Principles in Forcing Gladiolus. L. H. Jones. New England Gladiolus Soc. Yearbook, 1930.

CHANGES IN STAFF, DECEMBER 1, 1929, TO NOVEMBER 30, 1930

Appointments

Bennett, Emmett, B.Ed., Research Assistant in Chemistry, January 1, 1930.

Clague, John A., B.S., Research Assistant in Horticultural Manufactures, September 1, 1930.

Cleveland, Maurice M., B.S., Fellow in Horticultural Manufactures, September 20, 1930.

Donley, J. Elizabeth, B. A., Laboratory Assistant in Agricultural Economics, September 22, 1930.

Donnelly, Edward B., Technical Assistant in Floriculture, February 1, 1930.

Flint, Oliver S., B.S., Assistant Research Professor, Poultry Disease Elimination Law.

Jones, William L., B.S., Fellow in Agronomy, October 1, 1930.

Koon, Ray M., M.S., Research Professor in Vegetable Gardening, in charge of Waltham Field Station.

Foley, Richard C., B.S., Research Assistant in Animal Husbandry, April 1, 1930.

Larsinos, George J., M.S., Junior Chemist, Fertilizer Law, October 1, 1930.

McLaughlin, F. A., B.S., Assistant Research Professor, Seed Law, September 1, 1930.

Merriam, Oreana A., B.S., Laboratory Assistant in Home Economics Research, July 1, 1930.

Parkinson, Leonard R., Technical Assistant in Animal Nutrition, December 21, 1930.

Spelman, Albert F., B.S., Junior Chemist, Feed Law, January 13, 1930.

Stuart, William M., Jr., B.S., Research Assistant in Agronomy, October 1, 1930.

Voorneveld, Madaline, B.S., Laboratory Assistant in Home Economics Research, September 8, 1930.

Washburn, Doris E., B.A., Research Assistant in Farm Management, September 1, 1930.

White, Harold E., M.S., Assistant Research Professor in Floriculture, January 1, 1930.

Resignations

Alcock, James R., Technical Assistant in Animal Nutrition, December 21, 1929.

Church, Cornelia B., B.S., Laboratory Assistant in Home Economics Research, July 7, 1930.

Fernald, Henry T., Ph.D., Professor of Entomology and Head of Department, June 30, 1930.

Jones, John P., Ph.D., Research Professor in Agronomy, June 30, 1930.

Kelley, Joseph L., Technical Assistant in Cranberries, November 1, 1930.

Kelly, Oliver W., M.S., Seed Analyst, June 30, 1930.

Kuzmeski, John W., B.S., Junior Chemist, Feed Law, December 31, 1929.

Rice, Cecil C., B.S., Research Assistant in Horticultural Manufactures, September 1, 1930.

Shilling, Katherine E., A.B., Laboratory Assistant in Agricultural Economics, September 15, 1930.

Tiedjens, Victor A., M. S., Assistant Research Professor in Vegetable Gardening, June 30, 1930.

Zielinski, John B., Jr., B.S., Junior Chemist, Fertilizer Law, September 30, 1930.

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